The RUBBER AGE

April, 1940

TECHNOLOGY DEPT.

TECHNICAL PROGRESS

KALVAN

A New Compounding Material for High Tear Resistance

*

KALVAN is a calcium carbonate of very fine particle size. It will produce in white or brightly colored rubber an unusually high tear resistance.

Samples and Literature available.

*

R. T. VANDERBILT CO., INC.
230 PARK AVENUE, NEW YORK, N. Y.

NEOPRENE IS Flame Resistant

USE IT WHERE RUBBER IS A FIRE HAZARD!
It does not support combustion!
NEOPRENE burns slowly while in flame
... but extinguishes itself when removed.
RUBBER on the other hand burns in flame...
and continues to blaze when removed
DU PONT
REG. U.S. PAT. OFF.
E. I. DU PONT DE NEMOURS & CO.
(INCORPORATED)
RUBBER CHEMICALS DIVISION
Wilmington, Delaware

THE RUBBER AGE, published monthly by The Palmerton Publishing Co., Inc., Printing Office, East Stroudsburg, Pa. Editorial and Advertising Offices at 250 West 57th Street, New York, N. Y. Entered as second class matter October 20, 1933, at the Post Office at East Stroudsburg, Pa., under the Act of March 3, 1879. Subscription in United States, $2.00 a year. Canada, $2.50; Foreign, $3.00. April, 1940. Vol. 147, No. 1.

PRINTED IN U. S. A.

M. E. LERNER
Editor

W. GLEED COE
Production Manager

R. E. GAINES
Circulation Manager

PETER P. PINTO
General Manager

THE RUBBER AGE

ESTABLISHED 1917

One of the World's Outstanding Rubber Journals

APRIL
1940

VOLUME 47
NUMBER 1

INDEX TO CONTENTS

Some Properties of Perbunan—*By I. E. Lightbown* 19

Organic Rubber Accelerators—*By Robert L. Sibley* 22

Progress in Rubber From Goldenrod 25

Royle Celebrates 85th Anniversary 26

Deteriorants of Covered Rubber Yarn 28

Softening of Rubber 28

Glycoseal 28

Advances in Latex Technology: Part II—*By Royce J. Noble* 29

Flame-Proofing Agent for Textiles 34

REGULAR DEPARTMENTS

New Equipment Section ... 46
Book Reviews 49
Editorials 35
Late Domestic News 36
Financial News 40
Names in the News 41
Coming Events 38
Obituaries 44
Los Angeles News 42
Rubber, Cotton Markets ... 52
Chemical Markets 55
Statistics 56
Market Place 61
Classified Ads 65

Also Publishers of:

RUBBER RED BOOK
Directory of the Rubber Industry
Published Bi-Enially

ANNUAL BIBLIOGRAPHIES OF RUBBER LITERATURE
Compiled by D. E. Cable, Ph.D.
First issue covers year 1935

LATEX IN INDUSTRY
By Royce J. Noble, Ph.D.
Text Book on Latex

LATEX AND ITS INDUSTRIAL APPLICATIONS (Vol. I)
By Frederick Marchionna
Bibliography of latex patents and literature to June, 1932.

LATEX AND RUBBER DERIVATIVES AND THEIR INDUSTRIAL APPLICATIONS (Vols. II & III)
By Frederick Marchionna
Bibliography of latex patents and literature from June, 1932 to January, 1937; rubber derivatives to January, 1937.

Published on the 15th of each month by

PALMERTON PUBLISHING COMPANY, INC.

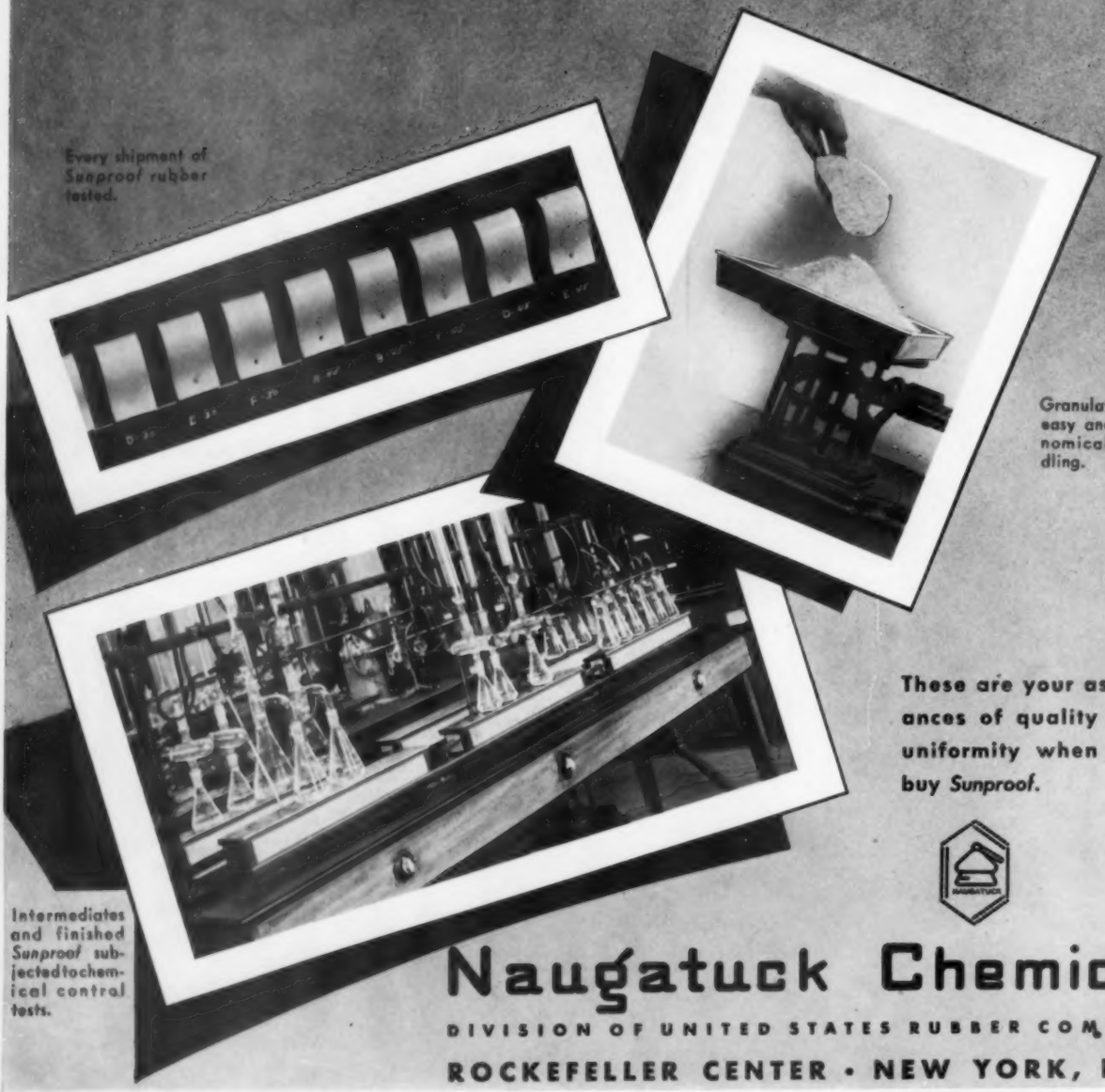
Printing office,
East Stroudsburg, Pa.

Editorial and Advertising Offices,
250 West 57th St., New York City

Entered as Second Class Matter, October 20, 1933 at the Post Office at East Stroudsburg, Pa., under Act of March 3, 1879. Subscription Rates: Domestic, $2.00 a year; Canada, $2.50; Foreign, $3.00. Single copies up to 3 months old, 25 cents; over 3 months old, 50 cents. Telephone COlumbus 5-2923, 5-2924. Contents Copyrighted 1940 by the Palmerton Publishing Company, Inc. Indexed in Industrial Arts Index. OFFICERS: P. L. Palmerton, President; E. D. Osborn, Vice-President and Secretary; Peter P. Pinto, Treasurer.

CRACKING? FROSTING?

Use *Sunproof* to prevent these two frequent difficulties with rubber products caused by those enemies of rubber—atmospheric ozone and sunlight.



Every shipment of *Sunproof* rubber tested.

Granulated for easy and economical handling.

Intermediates and finished *Sunproof* subjected to chemical control tests.

These are your assurances of quality and uniformity when you buy *Sunproof*.

Naugatuck Chemical

DIVISION OF UNITED STATES RUBBER COMPANY

ROCKEFELLER CENTER • NEW YORK, N. Y.

The **RUBBER AGE**

VOL. 47, No. 1 **APRIL, 1940**

Although the Buna rubbers have been used commercially in Germany for many years, and experimentally in this country for the past few years, very little factual data on their properties and characteristics has ever appeared in the technical literature. Since the announcement that the Standard Oil Company of New Jersey has acquired the rights to manufacture Buna in the United States there has been much comment on this synthetic material in both the trade and public press. Accordingly, we feel that the following article on Perbunan, the American form of Buna N, which is one of the first to appear in the literature, and which is based on a paper presented at a meeting of the New York Group, Rubber Division, A.C.S., on March 15, is most timely.—The Editor.

Some Properties of Perbunan

By I. E. LIGHTBOWN

Chemical Division, Esso Laboratories, Standard Oil Development Company

IN SPITE of chemical and structural differences, Perbunan is more like natural rubber than any of the other synthetic rubbers commercially available. For example, it is vulcanized by sulfur; zinc oxide and fatty acids aid the cure; accelerators normally used in ordinary rubber speed up the vulcanization rate; it is cured by heat the same as plantation rubber is cured; it may be vulcanized in a press, in open steam, hot air, or by any of the other methods which are used for rubber to bring about the remarkable change we know as vulcanization. In addition, active gas blacks reinforce Perbunan the same as they do rubber, only to a greater and more remarkable extent. I shall say more about this phenomenon later.

It is probably unnecessary to go into any more detail about the similarities between natural rubber, with which we are all familiar, and Perbunan, with which many of us are at least slightly acquainted. In appearance, Perbunan resembles something which would be a cross between pale crepe and smoked sheet. It has, naturally, a distinct rubbery feel, and a slight, pleasant odor. It is mixed, calendered, extruded, etc., on the same machinery as is used for those processes in normal rubber manufacture.

Structure

Straight butadiene Buna, or even Perbunan, probably contains more molecular cross-bridges than rubber. Whereas rubber consists of long, individual chains with the isoprene units adding to each other in the 1-4 position—head to tail, like circus elephants in a street parade—the Buna molecules, particularly the "numbered" Bunas, are of a somewhat different molecular structure. When butadiene (not in aqueous emulsion) is polymerized by sodium, the polymerization apparently takes place through 1-2 addition and 3-4 addition as well as the "normal" 1-4 addition. This makes molecular cross-bridges. Or if we compare rubber molecules to a handful of loose strings, like tire cords, we may compare Buna to a square woven fabric.

The method of establishing the structure of polymer molecules is by ozone analysis, first suggested by Harries. It consists of ozonization, subsequent oxidation, then esterification and identification of the esters. More recent work of this kind has been done by Hill, Lewis, and Simonsen (*Faraday Trans.*, April, 1939) who have shown that there is not so much cross-bridging in copolymers polymerized in emulsion as straight

TABLE I

SWELLING OF PERBUNAN IN COMPARISON WITH RUBBER 30%P-33 STOCKS

Liquid in which sample immersed	*% Weight increase after 24-day immersion*	
	Rubber	*Perbunan*
n-heptane	105	No effect
Varsol	160	20
SAE 30 motor oil	35	No effect
White mineral oil (Nujol)	90	No effect
Benzene	225	214
Oleic acid	115	No effect
Amyl acetate	210	53
Cottonseed oil	41	No effect
Carbon tetrachloride	600	160
Diethyl ether	115	23
Acetone	No effect	97
Turpentine	330	25

butadiene by sodium. But there is, definitely, more cross-bridging even in Perbunan than in natural rubber. And this probably accounts for its more difficult mastication.

Mastication

There is no magic solution to the mastication problem. There is no special manner in which your hands may be waved or passed before the front roll to make Perbunan break down like rubber. Neither will heat plasticization, as is possible with Buna S, do any good. At present it simply must be accepted as one of the characteristics of Perbunan that it is naturally harder, tougher and drier than the rubber we are accustomed to looking at and working with. On the other hand, much of the difficulty the factory may have with calendering, tubing or general processing may be because the Perbunan was not properly masticated. So that we are met on the one side by the fact that Perbunan does not become plastic on the mill like rubber; while, on the other side, we are met by the opposing fact that it must be properly masticated to give easy processing properties.

The answer to this proposition is quite simple. The Perbunan must be masticated! And it can be masticated fairly easily if a few precautions are taken. These are, first, that the mill rolls be set closely—more closely than they are for rubber. Second, that the rolls be kept cold. Third, that the batch be small enough to pass continuously through the bite of the rolls.

TABLE II

COMPARATIVE LOSS IN TENSILE STRENGTH OF PERBUNAN AND RUBBER AFTER 14 DAYS' IMMERSION IN GASOLINE

(BOTH STOCKS CONTAIN 45% GAS BLACK ON THE GUM CONTENT)

	Tensile (lbs./sq. in.)	
	Perbunan	*Rubber*
Before immersion	4600	4200
After immersion	2650	0

TABLE III

PERBUNAN REINFORCEMENT BY GAS BLACK

Weight per cent of gas black on Perbunan content	*Tensile strength (lbs./sq. in.)*
Pure gum	700
10	1850
20	2700
30	2950
40	4140
45	4300
50	3850
60	4200

Softeners

Because Perbunan does not break down like rubber, it is even more important to use softeners. Regular rubber softeners may be used to advantage in Perbunan, but some very effective ones are different from those generally used in the natural product. These are similar to plasticizers used in the manufacture of Koroseal from polyvinyl chloride. This class includes dibenzyl ether; phthalic acid esters, for example, diphenyl phthalate; tricresyl phosphate and triphenyl phosphate. Other softeners effective in Perbunan are wool grease, factice, pine tar, coal tar, and rubber itself. This latter cannot, of course, be used in large volume where oil resistance is desired.

Some of the other general properties of Perbunan are that the sulfur content to induce a good vulcanizate need not be quite so high as for natural rubber. One to 2.5% on the Perbunan is quite sufficient. Overvulcanization such as we know in rubber is not a problem. Neither is reversion, Perbunan vulcanizates tending to harden or stiffen after prolonged periods of heating rather than softening. Analogously, during aging, no tackiness or resinification, as in the case of natural rubber, occurs—instead there is a stiffening. This phenomenon is observed also when Perbunan is exposed to steam or even hot air for a considerable time.

Oil Resistance

As all of you know, the name "oil-resistant rubber" is a contradiction in terms. There is no such thing as "oil-resistant rubber." When rubber is compounded to make it oil-resistant, it becomes progressively less and less like rubber, and more and more like leather or wood. This is, as you know, because natural rubber is soluble or is swelled in most oils. This is a natural characteristic and cannot be changed by compounding.

A few years ago, oil-resistant rubber was a problem of considerable proportion, but since the commercialization of oil-resistant plastics, it has fallen into the background. This is because synthetic rubbers, such as Perbunan, are themselves naturally oil-resistant and you cannot do much to harm this oil-resistance just as you cannot do much to help the oil-resistance of natural rubber. Table I shows the per cent weight increase of rubber and Perbunan compounded similarly, after 24 days immersion in various solvents.

Table II shows the effect on tensile strength of Perbunan, compared with rubber, after 14 days in gasoline.

Why nitrile groups in the polymer should produce a rubber which is oil-resistant is not easily understood. It is not merely because there are substituents sticking out from the main long polymer chain, because methyl rubber made in Germany during the first World War was not oil-resistant. Methyl rubber was made from dimethyl butadiene which has, of course, methyl groups in the 2 and 3 positions. In addition, Buna S, which is made under the same conditions as Perbunan, but has as starting materials butadiene and styrene rather than butadiene and acrylonitrile, is little more oil-resistant than natural rubber itself. Until future theoretical enterprise has explained the reasons for this, we must accept it as a phenomenon. It may be because the Perbunan molecule is not a pure hydrocarbon.

Carbon Black

Undoubtedly the most interesting aspect of Perbunan is the remarkable effect that carbon black has on its physical properties, particularly tensile strength. The effect almost seems to be what chemists once called affinity. That is to say, it almost seems as if a chemical reaction took place between the carbon black and the rubber. At any rate, what we recognize in natural rubber and have termed "carbon black reinforcement" is seen to an exaggerated degree in Perbunan. (Perhaps we should use the word "carbophilic" to describe those plastic substances that display this unusual affection for carbon black). Thus a pure gum Perbunan vulcanizate has a tensile strength of only about 800 pounds per square inch. But when about 40 to 50% of channel gas black is added, the tensile strength jumps phenomenally to 4,500 pounds per square inch, or even higher. Table III shows the progressive increase in tensile strength with progressively greater volumes of channel gas black.

Most Perbunan compositions contain fillers of one kind or another to obtain optimum properties. And although channel gas blacks—the so-called active gas blacks—give a higher tensile strength and abrasion resistance, other fillers may be used equally well. The semi-reinforcing chemical black Gastex may be used to advantage for many purposes. Also, thermatomic blacks are valuable, these more especially where high loading for increased oil-resistance, or other special properties, are involved. This is again similar to regular rubber compounding practice.

Other pigments which give some degree of reinforcement, although not so much as the blacks, are: finely divided zinc oxides, light calcined magnesia, magnesium carbonate, and clay. Fillers such as whiting, lithopone and barytes produce but little reinforcement. Tensile strength reinforcement of P-33, zinc oxide, and clay are shown in Table IV.

But certainly the active gas black stocks—even if such compositions were commercially useless—are far and away the most interesting from a strictly scientific viewpoint. Let us enter the realm of fantasy for a moment and see what would happen if rubber could be reinforced to the same degree as Perbunan. Table V shows the actual pure gum and carbon black loaded tensile strength of Perbunan in comparison with the actual pure gum tensile strength of natural rubber. Using the percentage increase found for Perbunan (550%), the tensile strength of black loaded rubber stock is calculated as indicated in the table.

We can see that if natural rubber were reinforced five times over in tensile, as in Perbunan, we could use it for a structural material and, perhaps, have our automobile bodies made from rubber as well as our tires.

As I have said, this remarkable reinforcement, this tremendous increase in tensile strength with carbon black incorporation, should be of great scientific importance. An investigation of this phenomenon might lead us, for instance, to a solution of the general reinforcing problem. Let us look for a moment into a different field in order to draw an analogy.

In the precinct of genetics, the study of the fruit fly, the *Drosophila Melanogaster*, has been used very effectively to predict the hereditary traits, and the transferred physical qualities and characteristics of animals and human beings. Why has the fruit fly been used rather than man himself? Because in human beings the chromosomes and the bead-like genes which carry our packages of heredity are too small to see, or at least to study effectively under the microscope. On the other hand, certain chromosomes and genes of the fruit fly are gigantic in spite of the minute size of the ***Drosophila*** in relation to a six foot-four football player. Under the entomologist microscope these *Drosophila* genes may be observed and studied; they act the same as our own genes but their size is exaggerated; and by this study the hereditary traits of human beings are determined.

Analogously, it may be that, quite aside from Buna's value as a synthetic rubber—it may be that, from a strictly theoretical standpoint, the reason can be found out why channel gas black has its peculiar reinforcing action on rubber. For, as I have said, the reinforcement of Perbunan is a five-fold exaggeration of the reinforcement of rubber, and because of this five-fold exaggeration it may at last be possible to resolve the problem of carbon black reinforcement which has been tickling the brain of the chemist for the past twenty years or more.

TABLE IV

TENSILE STRENGTH REINFORCEMENT OF PERBUNAN WITH VARIOUS PIGMENTS
(50% LOADING ON PERBUNAN)

Pigment	*Tensile Lbs./sq. in.*	*Elong. %*
Pure gum	700	450
P-33	3560	625
Zinc oxide *	3100	650
Clay **	2350	650

(*) Kadox, Black Label 15
(**) Whittaker, Clark and Daniels Micronized Clay

TABLE V

	Pure gum tensile lbs./sq. in.	*Gas black loading lbs./sq. in.*
Perbunan	800	4500 (actual)
Rubber	3500	20000 (calculated)

Organic Rubber Accelerators

By ROBERT L. SIBLEY

IT was only last year that American rubber chemists were observing the one hundredth anniversary of Goodyear's discovery of the vulcanization process. Goodyear and others, shortly after 1839, described and patented the use of inorganic bases such as basic lead carbonate, magnesium carbonate, lime and the like as activators of the vulcanization process. For a period of sixty-five years following Goodyear's discovery, comparatively little progress was made in developing the use of chemicals in the rubber industry and it was only during the past twenty-five years that the use of organic products as vulcanization accelerators received much attention. During this recent brief period, the development of new effective products has been most rapid.

The history of this development is extremely interesting. Although Rowley in a British patent issued in 1881 described the use of ammonia or solutions liberating ammonia on heating a sulfurized rubber fabric, he failed to observe, as did the investigators following him, the effect of such basic materials on the curing process. Apparently the first publication relating to this field is a British patent to Ostwald, published in 1910, which described the use of aniline, among other materials, as an anti-oxidant of linseed oil, rubber and other organic products. Here again, the invention apparently was not followed as no commercial use of the development is known.

Patents of Hoffman and Gottlob

The first publication definitely recognizing and mentioning the acceleration of the vulcanizing process is found in the patents of Hoffman and Gottlob. These investigators, who were studying the production of synthetic rubber, observed that such synthetic products could not be vulcanized with sulfur, unless nitrogen containing organic products were present. This discovery was then extended to use with natural rubber. In their British patent published in 1914 and their U. S. patent issued in 1915 the patentees claimed the use of organic or inorganic compounds possessing a basic dissociation constant greater than 1×10^{-8} and which are basic at vulcanization temperatures. The particular materials described in this patent were aldehyde ammonia and hexamethylene tetramine. Another patent of about the same date issued to the same inventors described the dithiocarbamates produced from piperidine and from dimethyl amine. The Hoffman-Gottlob patent was involved in litigation in 1926, and the patent was held invalid not only on the ground of insufficient disclosure and too great scope of the claims but also because of prior use.

Testimony given in that trial disclosed much information that had up to then been maintained secret regarding the commercial development of organic accelerators in this country. This work was described and published in 1933 by Oenslager in his acceptance of the Perkin Medal, awarded him because of his pioneering and outstanding work in that field. According to these disclosures, aniline was the first organic substance found that possessed rubber vulcanization accelerating properties. Aniline however was most objectionable, first because of its liquid nature and secondly and more important because of its toxic properties. The discovery at about this same period that zinc oxide activated organic accelerators was of prime importance and resulted in the use of this material with practically all accelerators developed since that time.

Introduction of Thiocarbanilide

The use of aniline as an accelerator was for a few years only and it was soon replaced by diphenyl thiourea, more commonly known as thiocarbanilide. This product is manufactured by the reaction of aniline with carbon disulfide and is a solid non-toxic material. This substance was rather widely used as an accelerator for several years and even today is still employed for certain types of stocks, such as tire bead stocks, footwear and rubber cements, although in comparatively small quantities. The next accelerator uti-

Robert L. Sibley is Director of Research, Rubber Service Department, Monsanto Chemical Company. His laboratory is in Nitro, West Virginia. Dr. Sibley is a graduate of Clark and Princeton Universities. He taught chemistry for seven years at Hobart College and the University of Akron, and then entered the research department of the Goodyear Tire & Rubber Company at Akron, coordinating research and patent development. From 1921 to 1926 he served with the Standard Oil Company of New Jersey as a patent attorney. In 1929 he joined Monsanto as director of research activities. Dr. Sibley has more than 50 patents to his credit on chemicals and processes in the rubber industry and is well qualified to discuss the development, present use and future possibilities of organic rubber accelerators. The accompanying paper was presented before the Rhode Island Rubber Club on March 1, 1940.

lized to any great extent was hexamethylene tetramine, produced by the reaction of ammonia and formaldehyde. The use of this product again was objectionable in that it developed dermatitis or rash on many workmen handling stocks containing it. Aldehyde ammonia, para phenylene diamine and p-nitroso dimethyl aniline were used to a limited extent at about this same time but none of these products was of much interest and all were rather high in cost. (Any use of these materials at this time is for special types of rubber stocks only.)

The Aldehyde-Amine Accelerators

Consequently the rubber industry was quite ready to adopt any other suitable substitute product as soon as it became available. Such products were supplied about 1919 by the various aldehyde-amine accelerators of which several were offered on the market during the following few years. These products are formed by the reaction of a primary aromatic amine, generally aniline, with several aldehydes including formaldehyde, acetaldehyde, butyraldehyde, crotonaldehyde, acrolein, and heptaldehyde. These products are all either low-melting solids, such as methylene dianilide, or liquids, such as the butyraldehyde and heptaldehyde products or materials intermediate between the liquid and solid state, such as the acetaldehyde product. This latter product however could, it was found, be hardened to a solid resinous material that could be ground to a powder by treatment with formaldehyde.

The first products of the aldehyde-amine type were mol to mol reaction products, while the latter and more effective products of this type were formed by the reaction of more than 1 mol of aldehyde to 1 mol of amine. These aldehyde-amine products were used in large volume in the rubber industry for a period of several years and although their popularity has greatly diminished are still employed in many stocks, particularly for hard rubber, for air bags, steering wheels, in footwear and as activators of certain other types of accelerators. These accelerators as a class produce stocks of good aging characteristics. In general, they produce stocks lower in modulus than do present day accelerators. The lower members of this series are most effective at curing temperatures of forty pounds steam pressure, while the butyraldehyde and heptaldehyde products are used at temperatures of thirty pounds steam pressure. Reaction products of aniline, or other primary amines, with branched chain aldehydes, are practically without effect as accelerators.

While the aniline reaction products of the straight chain aldehydes containing from one to seven carbon atoms all have been used commercially, other aldehyde-amine products have not proved of much interest. However, the higher members of the series of aliphatic straight chain aldehydes are not commercially available. Research interest in this class of products has diminished very greatly as is indicated by the patent literature, comparatively few patents claiming the use of such products as accelerators having been granted during the past ten years. Although other amines than aniline have been investigated as materials to react with aldehydes to product accelerators, very few ever were used commercially. A para-toluidine-formaldehyde product is still available.

The next accelerator to be employed in large volume in the rubber industry was diphenyl guanidine which was introduced about 1922. This product was first produced by desulfurizing thiocarbanilide with litharge in the presence of ammonia but this process was soon replaced by the simpler and more economical process now followed of reacting aniline with cyanogen chloride. This product remained a most popular accelerator for several years and still is being used in relatively large volume. It is thought that guanidine compounds as a class even today comprise the second largest volume accelerating products used in the rubber industry. A number of other guanidine derivatives have been and many still are utilized by the industry, including mono phenyl and tri-phenyl guanidines, di-o-tolyl guanidine and the acetate and phthalate of diphenyl guanidine. While diphenyl guanidine when first available was generally employed in practically all types of rubber goods, its chief uses at the present time are in mechanical goods and as activators of other types of accelerators. They are also used to some extent in special stocks.

The patent claiming the use of diphenyl guanidine in rubber is of unique interest in that it is the only patent covering rubber specialty chemicals ever to have been litigated before the Supreme Court. The patent after four years of litigation was finally held invalid in 1928 on the ground that the patentee was not the first inventor.

The last important change in commercial rubber accelerators occurred in 1926 when mercaptobenzothiazole was first introduced. The development of this product is of interest. Bedford had been granted patents in 1921 covering the manufacture and use as accelerators of the sulfur reaction products of such commercial accelerators as methylene-anilide, hexamethylene tetramine, p-nitroso dimethyl aniline and thiocarbanilide. Bedford and Sebrell, in subsequent investigation of this last product, identified mercaptobenzothiazole as the active material present. Kelly about that same time patented the process of manufacturing this product by the reaction under pressure of aniline, sulfur, and carbon disulfide. The compound is produced rather simply by heating aniline and sulfur with a slight excess of carbon disulfide at temperatures of 240-250° C. for about fifteen hours under a pressure of 700 to 900 pounds per square inch. Hydrogen sulfide is freed as a by-product in this reaction. The product from this reaction is purified by solution in caustic soda and precipitation by acid. Mercaptobenzothiazole is not only faster in action but is also more effective at lower vulcanizing temperatures than the guanidines and aldehyde-amines and consequently replaced to a large extent these latter materials in a large number of different types of rubber goods. At the same time other problems arose which were solved in various ways.

Derivatives of Mercaptobenzothiazole

One most effective means of overcoming any difficulties experienced in the factory handling of the stocks accelerated with mercaptobenzothiazole was found to comprise the formation of chemical reaction products of mercaptobenzothiazole. This substance, unlike the commercial accelerators that had preceded it, which were basic in nature, is acidic, and while weakly acidic, none the less forms salts such as the sodium, zinc and lead salts. The sodium salt is

water soluble and readily undergoes reactions. Furthermore, mercaptobenzothiazole being acidic, will form salts with bases. Although aniline is too weak a base to form a stable salt, other stronger bases will react. Thus, diphenyl guanidine forms a salt of mercaptobenzothiazole but it is so very active that its use in a rubber compound is not generally possible because of its serious scorching tendency. The hexamethylene tetramine salt is somewhat safer to handle and this accelerator was available on the market for a ten-year period. Generally speaking, derivatives of mercaptobenzothiazole are far more desirable from all standpoints except possibly for certain special uses than are the amine salts of the acid and furthermore possess a certain desirable amount of delayed accelerating action and pre-vulcanize at higher temperatures than the thiazole compound itself.

One of the first of such reaction products available was dinitro phenyl benzothiazyl sulfide manufactured by the reaction of sodium mercaptobenzothiazole with 2-4 dinitro chlor benzene. This product itself is comparatively weak as an accelerator but it is greatly increased in activity by admixture with other basic accelerators, preferably with diphenyl guanidine. This synergistic effect was first employed, to our knowledge, in the case of this mixture although the two accelerator effect is now very commonly and widely employed in the industry. This blend of accelerators was and still is used for many purposes such as tire and tube stocks, drug sundries and mechanical goods. The blend is a particularly desirable footwear accelerator as it produces dry surfaces of high gloss although it cannot be used for white stocks as it produces a yellow to pale brown color in the vulcanizate.

Another interesting derivative is benzothiazyl-thiobenzoate obtained by the reaction of sodium mercaptobenzothiazole with benzoyl chloride. This accelerator also is comparatively weak when used alone but is greatly activated for example with diphenyl guanidine or its phthalate to produce tire and tube stocks or footwear and proofing stocks, or with litharge or 2-4 diamino diphenylamine to produce stocks of good electrical properties, or with thiuram sulfides to produce a flat white stock.

Additional Derivatives of Mercaptobenzothiazole

Among the other derivatives of mercaptobenzothiazole in commercial use is dibenzothiazyl dimethyl-thiol urea. This product is obtained by the reaction of mercaptobenzothiazole, formaldehyde and urea in a solvent. This accelerator is particularly desirable for use in high clay containing stocks and consequently is an excellent accelerator for heels and soles and other mechanical goods. The product is activated by basic accelerators, especially diphenyl guanidine and its salts, such as the phthalate for tire and tube stocks, and also is activated by ultra accelerators such as piperidine pentamethylene dithiocarbamate for latex stocks.

Other derivatives in commercial use are the zinc salt of mercaptobenzothiazole and a reaction product of mercaptobenzothiazole, formaldehyde and an amine, probably aniline, both of which are used for tube and tire stocks. Also the potassium and sodium salts of mercaptobenzothiazole are used in latex compounds in conjunction with some of the new low temperature or ultra accelerators.

One mercaptobenzothiazole derivative of commercial interest is the disulfide. This product is formed by the oxidation of a solution of the sodium salt of mercaptobenzothiazole with such oxidizing agents as chlorine, hydrogen peroxide, sodium nitrite and ammonium persulfate. The product is used for various types of rubber stocks and is a high modulus accelerator possessing a reasonably high critical temperature. Because of its reduced tendency to scorching, the disulfide can be activated with basic accelerators, such as the guanidines and their salts, including the phthalate, and produce stocks that are safer from a handling standpoint than those containing mercaptobenzothiazole itself, similarly activated. This is an important factor from the rubber manufacturer's viewpoint.

Another mercaptobenzothiazole derivative recently marketed that possesses marked anti-scorching tendencies is cyclohexylaminothio benzothiazole. This product is produced by forming the cyclohexylamine salt of mercaptobenzothiazole and then oxidizing off two hydrogen atoms by means of hydrogen peroxide. Although this compound includes its own activator in its composition, it also can be used with guanidine activation without developing a scorching stock. It is used in stocks containing high carbon black ratios and also in gum stocks. Except for the slight discoloration of white stocks it can be used in many different types of goods to advantage, particularly in sponge stocks and mechanical goods and in dry heat cures.

Dithiocarbamates for Latex Work

Although the first published disclosure of an organic accelerator was made in the Hoffman-Gottlob patent in 1915 of certain dithiocarbamates, these products could not be employed in milled compounds because of their serious scorching tendencies. This class of compounds then, was not used commercially until the use of latex became common for which use they are particularly effective due to their low-temperature curing characteristics. Some of these products will cause rubber to cure at or very close to room temperature. Others are effective at about 90° C., and some can be employed at temperatures of about 105° C. These compounds are all formed by the reaction of carbon disulfide with secondary aliphatic or cyclic amines, such as dimethyl amine, diethyl amine, dibutyl amine, diamyl amine and piperidine. The dithiocarbamates of cyclohexylamine have also been adopted recently. Certain xanthates such as zinc butyl xanthate, produced by the reaction of butyl alcohol, carbon disulfide and a zinc salt, are employed as latex accelerators. The metallic salts, particularly the zinc salt of the dithiocarbamates, are also utilized to considerable extent in latex compounds instead of the amine salt thereof.

The dithiocarbamates undergo one interesting reaction to produce another class of important accelerators. These compounds may be oxidized, for example by means of hydrogen peroxide, ammonium persulfate and other oxidizing agents, to produce the thiuram disulfides. These compounds are of particular importance in that on heating they liberate approximately 13% of their weight of sulfur and hence may be employed in stocks without the addition of free sulfur, thereby avoiding scorching troubles during milling and handling of the stocks. In other words, the thiuram disulfides not only are accelerators but also are sulfur

liberating materials. This property is taken advantage of in several types of stock, particularly in wire compounding.

The thiuram disulfides on reduction, for example with sodium cyanide, lose sulfur, and are changed into thiuram mono sulfides. Such compounds, while not sulfur liberators, are none the less effective low-temperature fast accelerators and are especially good where non-staining of the stock is of importance. The thiuram mono sulfides also function as activators of mercaptobenzothiazole accelerators for low temperature cures.

In general the same organic accelerators previously mentioned are utilized in foreign countries as are employed in the United States. Differences in factory conditions however, as well as differences in the raw materials situation, have resulted in the development and use of some few products abroad that never were popular or were not adopted in this country. The important accelerators in use the world over however are those particularly mentioned in this discussion.

It is interesting to note the long dependence of the accelerator industry on aniline as a raw material. From the time of the first use of aniline by Oenslager to the present, this product or its derivatives has served as the main source of acceleration to the rubber industry.

Inasmuch as comparatively little has been published in the chemical literature regarding organic accelerators, it is thought that a brief consideration of the patent literature in this field may be of some interest. The first patent in this country claiming as the invention the acceleration of the rubber vulcanization process was issued on January 20, 1915. From that time to January, 1921, or for a six-year period, there were issued but 12 U. S. patents in this field. From 1915 to date there have been granted a total of 412 patents in this country relating to organic accelerators. Of these about one-quarter, or 106 patents, have claimed mercaptobenzothiazole, its derivatives, reaction products and analogues. This comprises the largest single group of issued patents. There have been granted 56 patents claiming various types of aldehyde-amine products, of which not more than 6 have been issued during the past eight years. The third largest class of patents comprises the dithiocarbamates, of which 44 have been granted, over half of which have been issued during the past ten years. There have been issued 30 patents relating to various guanidine compounds, 11 relating to thiuram sulfides, 6 to xanthates and 11 to amines. Practically all the patents claiming amines as accelerators were issued shortly after the first use of such materials as organic accelerators became known.

It should be noted that all the patents mentioned are included within the classes of the commercially important accelerators and these comprise approximately two-thirds of all the patents issued in this field of products. Additionally there have been granted 148 other accelerator patents, including a number of different classes of compounds, relatively few of which attained commercial importance although some of these have been employed at various times for different purposes. Some few of these are still in use.

The book entitled "Compounding Ingredients for Rubber," published in 1935 by the *India Rubber World*, lists 64 different accelerators in use in the United States, while the latest edition of the "Rubber Red Book," published in 1939 by RUBBER AGE, lists a total of 98 accelerators. Eliminating so far as possible duplications in these lists, it appears that approximately 40 different products are in general use in this field with practically all 40 products falling within the scope of the classes particularly discussed.

It is difficult to predict what changes may take place in the future in this field of activity. Indications point out a stabilization in products with the probability that the present day accelerators will remain in general use for some time to come. At least the active search for new and improved accelerators on the part of chemical manufacturing companies appears to have decreased somewhat, if we can take the number of new patents issuing in this field as of any significance and importance.

Progress in Rubber from Goldenrod

ACCORDING to word received from the Division of Plant Exploration and Introduction of the Bureau of Plant Industry, Department of Agriculture, Washington, D. C., considerable progress has been made in the selection of high-yielding strains of goldenrod and the extension of these strains to small-scale field experiments. Individual samples have been found to contain as high as 13% rubber in the leaves and many samples have been found to contain 10% or better. On a field scale, however, the best strains are running approximately 8%.

Loren G. Polhamus, associate technologist of the Division, states that there appear to be conditions under which a high rubber percentage is obtained in the goldenrod, but usually this is at the expense of the leaf yield and efforts now are to combine a maximum leaf yield with the highest rubber percentage possible.

The Division's experiments are being conducted along two lines: (1) The isolation of strains which give a very high percentage; and (2) The isolation of strains which give a maximum leaf yield. In current breeding experiments, the technologists are attempting to combine both qualities in a single plant. The variability which has been noted among individual plants of a single strain seems to indicate that small differences in soil or fertilizer elements affect the yield and rubber content materially, and, accordingly, the Division is attempting to determine the optimum conditions for obtaining the best possible yield of rubber per acre.

Most of the cultural requirements of goldenrod have been determined, reports Mr. Polhamus, as well as dates of planting and dates of harvest. In this respect, the present experiments are designed to determine the best method of treatment of old beds after the first year. Latest tests indicate that in the first year yields of only 75 to 100 pounds of rubber per acre may be expected, but that by suitable treatment of the beds the yields in the second year may be as much as 250 pounds per acre.

The experiments with goldenrod conducted by the Division do not assure the future practicability of producing rubber from the plant on a commercial scale, but they do indicate that the goldenrod may be considered an important emergency source of supply.

Former Royle Factory, Circa 1880.

Royle Celebrates

IN the same way that Edison is identified with electric lights, Morse with the telegraph, Bell with the telephone, the name Royle is associated with extruding machines. Ever since the first Royle tubing device was introduced to the rubber industry in 1881 the family name has been closely identified with that industry. The firm of John Royle & Sons this year celebrates its 85th anniversary. Its history warrants the telling.

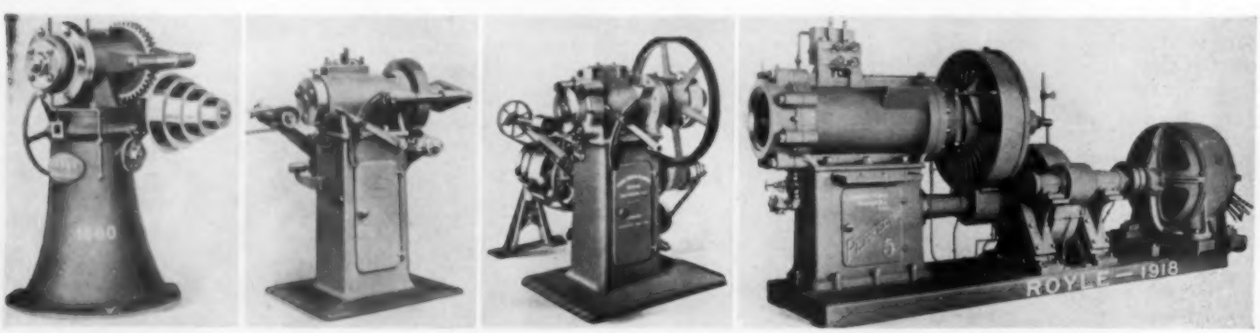
John Royle, Sr., founder of the company, was born in England in 1822. The Royle family came to the United States in 1830 and settled in Paterson, N. J. The future founder of the present Royle company received the usual rough education in the public schools and undoubtedly served as apprentice to one or more machinists of the day. In 1855, however, he launched his manufacturing career, producing rotary force pumps.

For seven years Mr. Royle concentrated his activities on pumps, but in 1862 he rented a small room in Water Street, Paterson, and started a general machinists business. Around this time the company began the production of photo-engraving machines, principally a routing device. Later cabinet saws, bevelers and lining-bevelers were added to the line. The manufacture of machinery for photo-engravers is still an important portion of the present Royle business.

By 1872 the firm of Royle had secured a firm wedge in the specialized machinery business. About this time John Royle, Jr., joined his father in the operation of the firm. Vernon Royle, another son, was admitted to the company in 1877. The firm of John Royle & Sons, however, was not incorporated until 1898, with Vernon Royle as president and treasurer, and Heber Royle, a grandson of the founder, as secretary. Shortly after John Royle, Jr., joined his father the company began to experiment with silk machinery, a natural move since Paterson was rapidly becoming a silk center. When Vernon Royle joined the company its activities in this direction increased considerably and soon the firm was busily engaged in the manufacture of a wide variety of silk machines, particularly the Royle Positive Action Automatic Repeater for Jacquard Cards.

View of assembly room in the Royle plant taken in 1908.

It was not until 1880 that the Messrs. Royle gave any thought to the manufacture of extruding machines. The company was looking about for something new to manufacture and, as the late Vernon Royle, former president of the company, put it, "without knowing just why, we hit upon the idea of a machine to form rubber into a seamless tube by forcing through a die under screw pressure." The general practice of the day was to make tubing by hand over a mandrel.



A pictorial presentation of Royle Extruding Machines from the early days of the

85th Anniversary

Present Royle Plant in Paterson.

The design of the first Royle extruder, which was of the bell base type, is strikingly similar to the modern machines. It had a jacketed cylinder, a worm-and-gear drive, and a take-off mechanism, all built upon a hollow pedestal. The modern machine has these same elements, perfected and strengthened. The head of the first tuber was cast with water jacketing, and there were separate inlets for steam and water to the head and cylinder, much as now in principle.

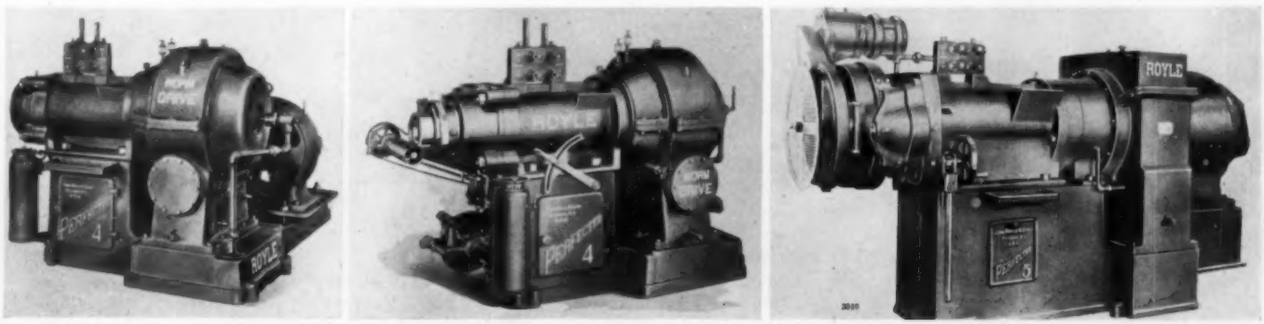
View of the present assembly room at the Royle factory.

An odd fact now presents itself: Although the Royle concern devised and built an extruding machine for rubber in 1880, neither the founder of the company or his two sons had ever been inside a rubber factory. Still more odd is the additional fact that none of these gentlemen stepped inside a rubber factory for the next twenty years. And during that time the Royle extruders took firm hold and received recognition as the only practical extruders for rubber. This peculiar state of affairs is attributable to the great secrecy practiced by rubber manufacturers prior to the turn of the century. So fantastic was this secrecy that Royle engineers were not permitted into factories to repair defects or to instruct workers in the proper operation of the machines.

Through the years major and minor improvements were built into the Royle extruding machines. The open jacket cylinder was replaced by a spirally cored cylinder; three friction washers and an oil-soaked fiber washer to receive the thrust replaced the original thrust bearing; a steam chest with valves was added to control circulation of steam and water to head and cylinder; intermediate gears were introduced when higher-speed electric motors made their appearance; modern worm-and-gear drives date back to 1923; still later developments called for the use of helical and herringbone gears.

In addition to these mechanical improvements a number of other features were developed and incorporated into the machines, such as the side-delivery head for insulating wire and later a self-centering head for the same application, and the adoption of strainer plates for use in the heads, this feature culminating in the gate-type expansion head for straining.

The present management of John Royle & Sons is in capable hands. Vernon E. Royle, grandson of the founder, is president; Clifford H. Ramsey, a cousin of the company's president, who has spent 18 years off and on with the concern, is general manager and treasurer; Justin H. Ramsey, his son, is vice-president; Robert H. Kelley is secretary; and Thomas C. Malcolm is assistant-treasurer. Charles J. Vollmer, connected with the company for the past sixteen years, is plant superintendent.



first open jacket cylinder type to the present smooth-running, perfected model.

Deteriorants of Covered-Rubber Yarn

COVERED-rubber yarn has several natural enemies. The yarn manufacturer, the weaver, the knitter and the finisher, however, can avoid many of the difficulties met with in handling these yarns and fabrics made from them by taking suitable precautions. An outline of these deteriorating agents and influences, together with the proper precautions to be taken, was given in a recent issue of *Textile World* by Charles E. Bergamini, which is reproduced herewith.

In the covering operation, atmospheric conditions play an important part in the production of uniform yarns. Temperature and humidity should be held fairly constant by means of automatically controlled air conditioning equipment. An increase in temperature and humidity will increase the ease of stretch of the rubber core. Therefore, with the tension remaining constant, yarns covered at high temperature and humidity have a greater number of turns of wrapping per inch, longer stretch, and less rubber per inch of covered yarn than that manufactured at lower temperature and humidity.

Because rubber shows a loss of resiliency with a lowering in temperature and humidity, yarns covered at low temperatures will invariably have twisted cores. This defect will show up in the dyehouse in the form of badly crinkled skeins should the yarn be skein dyed or bleached. A tendency to produce the rippled effect in finished fabrics is another result of twisted cores. A relative humidity of 60% at 70° F. is recommended for covering when the yarn is to be utilized for weaving purposes. The important thing, however, is to avoid wide variations in conditions. To a lesser extent, atmospheric conditions affect the winding and weaving operations in a similar manner.

Mill Equipment Should be Grounded

The menace of natural oxidation in air has, for all practical purposes, been eliminated through the use of various anti-oxidants. The effectiveness of these compounds holds also on exposure to nascent oxygen in the ordinary bleaching process. Repeated bleaching results in no appreciable damage. Ozone works faster, however, and is encountered wherever there is an electrostatic field. For this reason, all covering and winding apparatus, as well as looms, knitting machines, finishing equipment, etc., should be well grounded.

Deterioration from sunlight occurs most frequently during consumer use, although several cases caused by careless exposure of finished fabrics in mills have been brought to the attention of the writer. An exposure of 10 hr. to strong direct sunlight is often sufficient to destroy the elasticity of fabrics made from covered-rubber yarn. Obviously, laundered garments must be dried in the shade. Care must be exercised in mills, especially in the covering process and in the shipping room to avoid strong light sources. Wet processing is usually carried out in dyehouses which for other reasons, have already been safeguarded against sunlight.

For fabrics designed to be exposed to light, such as bathing suit fabrics with an acetate warp and rubber filling, a satin face is advisable, since this affords protection to the rubber by reflecting and dispersing the light rays. Retailers should be cautioned against displaying products containing covered-rubber yarns in unshaded windows.

Accelerated oxidation due to heat is usually confined to the drying operation in the mill. Temperatures in excess of 212° F. on cans or in air dryers are destructive. Too long an exposure in air dryers is the most common cause. Pungent, lachrymatory fumes may be accepted by dryer operators as an indication of over-exposure. Consumers should be warned that careless ironing of garments may cause deterioration.

Minute quantities of copper and manganese act as catalysts in the oxidation of rubber. Dyes, chemicals, and wet processing equipment should be free of these metals. Fabrics dyed with dyes containing copper and manganese, because of the intimate contact of the rubber and the dye, are doomed to a short life. Oils, fats, and greases are rapidly absorbed by the rubber, causing swelling, loss of elasticity, and premature deterioration. Finishers should avoid all softening and sizing materials containing such products. Although in many cases no immediate ill effect is apparent in the finished cloth, actually the life of the fabric has been shortened considerably. As a result, numerous returns are invited.

Softening of Rubber

AS RECEIVED by manufacturers, crude rubber has to be reduced by heating and mechanical working to a soft plastic condition to permit incorporation of compounding ingredients. Experiments have been carried out at the Rubber Research Institute of Malaya recently to determine if softening could not be more economically effected by modifying the preparation of the rubber on the plantation. A promising line of attack, according to reports on methods employed, is the treatment of latex prior to coagulation with substances such as zinc soaps which bring about softening in the course of the normal smoking and drying processes.

Pine tar is an effective softener in common use, and in view of the fact that it was found possible to incorporate large quantities into the latex, it is suggested that master-batch preparation on estates might be worthy of consideration by the manufacturers. The incorporation of emulsions of "peptizing agents" into the latex in the pre-coagulation stage is another method which has been used during the last two years for softening purposes. It is now shown that the degree of softness achieved depends to a large extent on the temperature at which the wet sheet is afterwards dried, high temperature in the early stages assisting the softening markedly.

Glycoseal

A JOINT SEAL completely resistant to propane, pentane, butene, benzol, gasoline, naphtha, grease and oils of all types has been developed by the Glyco Products Co., New York City. Called Glycoseal, the new material is flexible, leak-proof and non-cracking. It will not harden and joints may be broken easily without damaging the fittings, according to the company. It can be used on rubber, which it does not attack, as well as on all kinds of metal fittings. Its use in propane service, both liquid and gas, is pointed out as an example of its effectiveness under difficult conditions.

Advances in Latex Technology

By ROYCE J. NOBLE

Consulting Technologist and Author of "Latex in Industry"

PART II

Latex Types

In view of the limitations inherent in normal latex, it is not surprising that efforts were made early in the history of the industry to prepare concentrated forms. Standard creamed, evaporated and centrifugally prepared concentrates have been available throughout the period of commercial development. In recent years, with the coming of new applications, it has been necessary to carry the development of special forms of normal latex and concentrates a step further, principally in the direction of meeting process specifications.

T-Revertex is a new form of the standard evaporated concentrated Revertex, but has a solids content of 62 to 65%. It may be used in those cases in which a stable whole latex is required but in which the higher concentration of the older form is unnecessary.

Two new forms of vulcanized latex have been made to meet special requirements. B-Revultex is a concentrated form of vulcanized latex of 62% solids content. Z-Revultex is a purified form of concentrated vulcanized latex, containing a minimum of water-soluble materials.

Several new types of centrifuged concentrates have been placed on the market in the last two years. In one class are the concentrates of high solids content, covering the range of 62% to 65% total solids, which for special applications have been found very desirable. In another class are the highly purified concentrates, intended specially for electrical use.

With improved methods of creaming, it has been possible also to prepare new and better types of creamed concentrates. One of the best grades has a rubber content of 62% to 63% and is comparable in many of its properties with centrifuged material.

While the quality of normal latex has improved generally, there is a strong demand for normal latex of specially high grade in point of color, stability and cleanliness, and high solids. Most dealers now have products to meet these specifications.

Concentration Methods

As has been previously noted much effort has been devoted in recent years to the development of special forms of concentrates. The greatest activity has been directed toward the preparation of purified products, adapted for use in insulation and other applications in which a low content of water-soluble or water-absorbing substances is desirable.

Note: Part I appeared in the March, 1940, issue.

Centrifuging: Centrifugal concentration is of such long standing that developments have consisted only of improvements in the basic procedure. The desirability of maintaining the latex at an ammonia content of below 0.3% during centrifugal treatment and the necessity of special construction of separator discs to prevent clogging has been urged by Piddlesden *(41)*. Treatment to dehydrate the adsorbed layer of the particles accelerates separation of the concentrate. Heating the latex to 90 to 140° F. before processing results in more efficient operation *(42)*. Addition of volatile non-solvent organic liquids *(43)* or solutions of soap and gums *(44)* causes the separation of a concentrate of higher solids and accelerates the rate of separation.

Disposal of the serum obtained by centrifugal concentration on the plantation remains a problem. The magnesium chloride-sodium silica fluoride mixture proposed by Hastings is as satisfactory as any reagent for coagulating the serum prior to preparing it in the form of crepe.

Creaming: Interest in the mechanism of creaming and searches for new creaming agents are attributable both to the increased demand for concentrates and the expiration in Great Britain and Malaya of the principal patents. Several studies have been made concerning the behavior of the latex particles during the creaming operation, leading to entirely new conceptions of the changes taking place.

It was long the general belief that the function of creaming agents was merely to form a soft hydrophylic shell by adsorption on the latex particles, thereby increasing their effective size, decreasing their Brownian movement, and, in accordance with Stokes law, causing them to rise rapidly through the serum. The work of both Baker *(45)* and Vester *(46)* indicates that although adsorption on individual particles does occur, the real function of the creaming agent is to assist in the formation of loosely-bound aggregates, of such size that Brownian movement is stopped, and the aggregates are free to cream. The aggregates readily break up on dilution with water. A modification of this theory has been suggested by Twiss and Carpenter *(47)*, who believe that creaming agents, which always exhibit a structural viscosity, may not only be adsorbed on the surface of the particles, but may also form a network throughout the latex, and this network then tends to contract, separating the serum.

The Rubber Research Institute of Malaya has investigated a large number of possible creaming agents, especially those prepared from the seeds of legumes, some of which have been patented for use in latex.

The materials examined include not only many natural gums and starches, but certain water-soluble derivatives of the higher fatty alcohols *(48)*; none, however, surpasses tragon seed gum in effectiveness. It has been observed that increased ammonia content increases the rate of creaming.

Miscellaneous Methods: Electrodecantation as applied to purification and concentration of proteins was investigated by Pauli some years ago, and recently has been extended to the concentration and purification of latex *(49, 50)*. If latex is subjected to dialysis between semi-permeable membranes and at the same time is subjected to a low electric potential, the rubber particles move toward the anode and are deposited on the anode membrane as a reversible paste. If the potential is sufficiently low, the deposited rubber may rise to the latex surface to form a layer of concentrate in which form it may be separated. This process has not been placed in commercial operation as yet, although it is being actively developed.

A new type of apparatus for evaporative concentration has been proposed by the London Advisory Committee for Rubber Research *(51)*. Due to the design, rate of evaporation and difficulties that have been experienced in operation, it seems doubtful that this evaporator will replace the earlier forms of equipment. The standard methods of concentration of latex by evaporation have been improved by devising means of preventing skin formation, application of vacuum *(52)* and using special stabilizing agents *(53)*.

The method of concentration by freezing has been developed by Metallgesellschaft A. G. *(54)*. Its success is dependent on the separation of the water in the form of small crystals rather than as a solid mass. It is stated that the energy consumption in this method is about half that required for evaporation, with the added advantage that a purer concentrate is obtained.

Purification; Deproteinized Rubber

Although the centrifugal method of cencentrating latex effects considerable purification, especially if repeated, special methods have been developed directed essentially to the removal of proteins, water-solubles and other non-rubber substances from latex. Concentration may or may not take place at the same time, and the purified product may be coagulated or retained in the liquid state.

Dialysis of latex, as a method of purification, has long been of interest in the laboratory. Stevens and his associates *(55)* have constructed a pressure dialyzer for latex, of a size suitable for semi-commercial application. During dialysis at constant volume, concentration at the dialyzing membrane occurs.

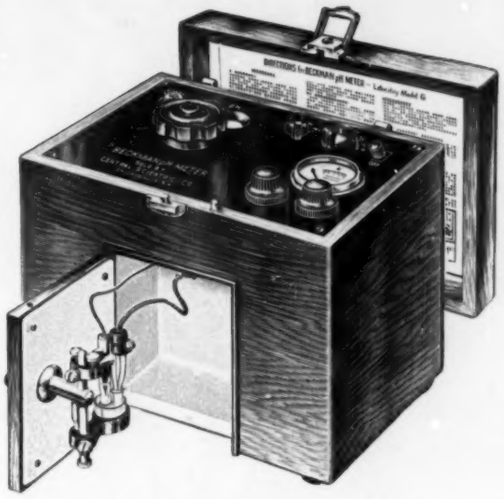
Purification by dialysis is not complete in that a large part of the nitrogenous substance remains in the latex. If the latex is treated with caustic prior to dialysis, a product having low nitrogen content is obtained. After dialysis of untreated latex, a crepe may be obtained having a water absorption value only slightly lower than that from undialyzed latex; it is claimed that 80

Interior View of a Centrifuging Plant on a Modern Plantation in Sumatra.

per cent of the diffusible constituents is removed. Electrodialysis has been discussed under concentration methods.

A comparative study of several methods of purification *(56)* has shown that the alkali-hydrolysis treatment is the most effective in removal of ash, nitrogenous and water-soluble substances, although the purified product is readily oxidizable *(57)*. Centrifugal treatment is more effective than creaming, although Rhodes found that centrifuging as many as 27 times did not entirely remove nitrogenous substances. Treatment with charcoal or silica gel is claimed to effect removal of water-absorbing substances *(58)*.

Kemp *(59)* and Boggs and Blake *(60)* have investigated the purification of latex and rubber, with a view to its use in insulation. They differ in their conclusions as to the controlling factors in water absorption but it seems probable that this depends on whether the rubber has been vulcanized; after vulcanization the water-soluble substances are chiefly responsible for water absorption.



Central Scientific's Beckman pH Indicator.

Artificial Latices

As the field of latex itself has expanded, so also has that of dispersions of crude rubber and reclaimed rubber, although not to so great an extent. The most important applications of dispersions have been in can sealing, adhesives and backing for rugs and fabrics, where their special properties are of value. Advancement in this field has been confined almost entirely to improvements on the original patents, such as the dispersing agents employed and the methods of incorporating them in the rubber. In addition to soaps, casein and clay, long used as dispersing agents, sulfonated aliphatic compounds of high molecular weight have been used *(61)*.

Of increasing importance are the emulsions of vinyl monomers and polymers as substitutes for, or in conjunction with, latex. The monomeric compounds are usually water-soluble; if a protective agent is added, polymerization to the desired extent may take place to yield a product in dispersed form, or polymerization may take place after the emulsion is applied. The polymers being saturated are not vulcanizable; they may be either thermoplastic or thermosetting.

The vinyl acetate and acrylic acid esters may be polymerized in emulsion to yield semi-fluid to hard films with excellent adhesive qualities. The vinyl acetates have poor water resistance, so that applications have been somewhat limited. Impregnation of fabrics, artificial leathers, adhesive and fiber board are some of the products and processes in which these dispersions have been used.

The polymerized acrylic acid ester latices give flexible films and have an advantage in being non-saponifiable and more water resistant. They are especially suitable for leather coatings and as permanent finishes for fabrics such as artificial leathers and oilcloths.

A third class, the polymerized vinyl chloride compounds in latex form have achieved considerable commercial importance. These polymers are non-inflammable, strongly resistant to corrosive acids and give strong tough films.

All the polymer latices above mentioned give films contrasting strongly in many of their properties with those from rubber latex. They are resistant to oils and grease and therefore serve in applications where latex is unsatisfactory. The films are generally tough but non-elastic, and in this respect may be less desirable than latex for some uses. These dispersions may be coagulated with the same reagents used for latex.

Neoprene in dispersed form (Type 57) is being used in specialized applications, in which resistance to oils is an important consideration. The methods of use are similar to those employed with rubber latex. Its properties are modified by compounding with such fillers as lithopone, carbon black, and whiting; the reenforcing effect of lithopone is remarkable in view of the lack of such reenforcement when used with rubber latex. Accelerators serve to improve the physical properties of neoprene films but do not accelerate the rate of cure. Thickeners, stabilizers and other compounding agents may be used as with rubber latex.

Now that rights for the manufacture of Buna have been acquired by an American company, dispersions of this material may soon become available to manufacturers in this country. Although dispersions of both Buna S and Buna N have been used in Germany, the S type is the one best suited for general use.

Compounding

Dispersing Agents: Several new materials intended for use as dispersing agents for sulfur, zinc oxide and fillers have appeared in the market. For the most part they are proprietary preparations, of which the composition is at present unknown. An advantage is claimed for one of these materials in that less than 1% on a dry basis is required for effective ball milling *(62)*.

Wetting Agents: Interest in chemical compounds possessing surface activity and in their use in latex compositions is increasing *(63)*. In the textile field especially, where wetting agents were first applied, these materials not only assist in the penetration of latex into fabrics, cords and the like, but may also stabilize it against flocculation in the presence of hard water *(64)*.

The wetting agents in greatest use today may be divided into two principal groups: *(a)* those derived from fatty acids and having a primary polar group, such as soaps, fatty alcohol sulfates and sulfated fatty

acid esters and amides, and *(b)* those having the polar group in a secondary position, such as the sulfated esters of higher alcohols and dibasic acids, and the secondary alcohol sulfates. The materials in the second class are reported to be superior as penetrants, while those of the first class excel as detergents *(65)*.

Stabilization: Some of the most interesting recent work on the factors affecting the stability of compounded latex has been done by Jordan *(66)*. It has been known for some time that the solubility of zinc oxide in ammonia to form a complex positive ion results in a decrease of stability and eventual coagulation. If the ammonia is removed or reduced to 0.15% by aeration or by treatment with formaldehyde, and the latex is restabilized with caustic potash in an amount depending on the characteristics of the individual sample, but sufficient to bring the pH to 10.7 to 11.0, the stability of the latex remains nearly constant at a relatively high value. At this pH value, the zinc is present in the form of monovalent zinc-ammonia hydroxide ion, which has only slight coagulating power.

A number of stabilizing agents have been developed for special purposes, and it seems probable that many of these would be suitable for general compounding work. The alkali metal salts of phosphoric acid esters of higher alcohols have been found effective as stabilizers during concentration *(67)*. Cetyl sodium sulfonate has been used as a stabilizer for vulcanized latex.

Fillers: Of considerable importance in the preparation of highly loaded compounds is the observation of Duarry-Serra *(68)* that terpineol, wood tar or isoprene homologs make possible the addition of fillers in large quantities without adversely affecting the properties of the dried film. The reenforcing effect of china clay and bentonite in latex films has been reported by v. Rossem and Plaizier *(69)*. Of present interest is the resistance of latex-bentonite films to mustard gas. Better association of fillers and rubber in latex films through the use of creaming agents is claimed by Carpenter *(70)*.

Accelerators: According to Sibley *(71)*, mixed accelerators, such as mercaptobenzothiazoles and dithiocarbamates may be used to advantage in latex. To prevent premature vulcanization of latex compounds, N-substituted dithiocarbamates in the presence of 0.5% NH_3 have been found effective *(72)*. It has been established by MacKay that water-soluble accelerators are not extracted in measurable quantity from latex films during vulcanization in water, due to their selective solubility in the rubber *(73)*.

Coagulation: Control of coagulation under all conditions is of the greatest importance, not only on the plantation but in nearly every application of preserved latex as well. The behavior of latex during flocculation and gel formation has been studied by van Harpen *(74)* who finds the rubber particles are connected by an adhesive substance amounting to about .03 per cent of the weight of rubber. This substance is precipitated by hydrogen ions, and then is rehydrated to form the adhesive; its function is largely dependent on the pH value.

Several improvements in coagulation methods have been suggested. The speed of coagulation is said to be increased by addition of soap or by the formation of a weak acid *in situ*, as in the impregnation of fabrics, and by many other substances *(75)*.

Coleman Model 3D pH Electrometer.

Rubber Powder

A new form of rubber powder has been developed at the West Java Experiment Station, and has been publicized under the name of "Mealorub." It is made by flocculating field latex with acid, the flocculate being separated by centrifuging, then washed and dried. It contains non-rubber substances up to about 4%, including the added sulfur and zinc oxide. It is stated that the sulfur present in the powder is not combined with the rubber but rather with the serum substances. It is also claimed that due to the method of preparation, the content of serum substances is about the same as that of crepe. A specially purified product is also available.

This form of rubber powder is only slightly cohesive; it is difficult, therefore, to soften it or form a sheet on the mill. When added to milled sheets, however, large quantities of the powder may be used. The suggested applications are in the fields of bitumen composition, rubber derivatives and molding powders.

Testing Methods for Latex

The subject of control testing and establishment of specifications has received much attention recently. Some of the larger latex companies and research groups have published details of methods of analysis *(76, 77)* which they have found reliable. The Crude Rubber Committee of the Division of Rubber Chemistry, A.C.S., in collaboration with the American Society for Testing Materials, has made an effort to establish standard procedures for testing methods. The tentative methods as recently published *(78)* are a step in the direction of desirable uniformity but in some instances it appears doubtful that the method selected will meet with general acceptance.

The British Standards Institution has also undertaken the preparation of standard testing procedure, with the cooperation of the research organizations of the British rubber growers. The proposed methods differ in many respects from those of the American Crude Rubber Committee. In the best interests of the

industry it is to be hoped that steps will be taken in the near future to formulate one set of standards for both groups.

Too much stress cannot be laid upon the proper method of sampling since this in turn determines the reliability of all other tests. Thorough mixing of the latex is essential. In tank cars and large bulking tanks good agitation may be obtained with air if well distributed; preferably agitators causing flow in the line of the greatest dimension of the tank are used. Drums should be stirred with a high speed mixer ten minutes or longer. The sample is withdrawn by a tube of small diameter long enough to extend to the bottom of the container; alternatively, samples may be obtained from top and bottom of the container by means of narrow mouth bottles.

The proposed A.C.S. method for total solids specifies the use of a 2 gram sample, weighed into a flat open dish. Obviously there is a possibility of considerable error in weighing a volatile substance under such conditions. It is desirable, when any great accuracy is required, to use a sample of not less than 10 grams preferably weighed by difference.

It has been proposed *(79)* to determine dry rubber content from total solids by use of a factor. Only for approximation is this satisfactory. Inasmuch as the ratio of dry rubber content to total solids may vary at least 1% in latices from different sources and at different times of the year, it will be readily seen that errors of considerable magnitude will result if this method is applied to the testing of large shipments actually sold on a dry rubber content basis. Murphy *(77)* asserts that an accuracy greater than 0.15% in determination of dry rubber content cannot be expected; actually this margin of error may be reduced to 0.05% if proper precautions are observed.

It has also been proposed to determine dry rubber content from the density of the latex, a table of densities from 40% to 60% solids being used for calculations. Because of natural variations in latex, necessity for careful temperature control and other factors, it is obvious that this procedure can give no more than approximate results, and could not be used as a basis for sale or purchase.

No color standards or specifications have been set up in this country, the custom being to specify the color as being "good white." In England it has been proposed to make standard color cards based on the colors of latices as observed in the Lovibond Tintometer *(75)*. Willott favors the use of a colorimeter *(80)*. The color of the dried films, unaged and aged, may be useful as an indication of quality.

Coarse dirt and sediment in considerable quantities may be found occasionally—a particularly objectionable condition if the latex is used in forming thin films, thread or any article of small gauge. The large particles may be removed on a fine (80-mesh) stainless steel gauze and the suspended matter determined centrifugally.

Although a chemical test for putrefaction based on the time required to reduce methylene blue has been suggested *(81)*, it is not entirely reliable. The general practice is to neutralize the ammonia with a saturated solution of boric acid, and observe the residual odor.

Several methods of determining mechanical stability have been described *(76, 82, 83)* but none have been adopted as standard. The Hamilton-Beach high-speed mixer is widely used in the United States, but details as to volume of latex, ammonia content and temperature are not standardized. In England, the high-speed stirring test is not regarded with favor; the test proposed by the London Advisory Committee, involving slow speed stirring (2000 r.p.m.) of a relatively large volume of latex in the presence of zinc oxide, is generally used. The effect of the kind and amount of zinc oxide and of temperature on this test is more important than the ammonia content. Any stability test is entirely arbitrary, and it is exceedingly difficult to formulate a procedure capable of evaluating a latex for different applications.

Leeds & Northrup's Universal pH Indicator.

A test for chemical stability has been proposed by Murphy *(77)*. The latex sample is adjusted to standard solids and ammonia content and allowed to react 24 hours at 20° C. with 5 per cent of zinc oxide. The viscosity after reaction is inversely proportional to the chemical stability.

The capillary-flow method proposed by Jordan, Brass and Rowe *(83)* for the determination of the viscosity of latex, and incorporated in the scheme of analysis sponsored by the American Crude Rubber Committee, is a cumbersome one, both as to operation and in calculation of results. Further, as has been pointed out *(84)*, the formula given for calculation is incorrect. Standard viscosity instruments of great accuracy are readily available, making possible the rapid and precise determination of viscosities.

Both the Hoeppler and Stormer viscosimeters are suitable for routine measurement of latex viscosities, and are capable of giving accurate results. The several considerations affecting the accuracy of the Hoeppler instrument, as applied to latex, have been discussed by Bachle *(85)*.

The glass electrode appears to be the most reliable and convenient method of determining the pH of latex.

Some investigators *(86)* have preferred the antimony electrode because it is unaffected by proteins and salts.

An entirely new method of making physical tests on latex films has been proposed by Flint and Naunton *(87)*. In view of difficulties experienced in the preparation of satisfactory vulcanized films of latex compounds in the usual thickness of .075 to .10-inch, due to sedimentation, length of drying time, and danger of pre-curing, they suggest a method in which thin films, not adaptable to the conventional testing procedure, are rapidly dried and cured, and then while clamped in a die subjected to water or air pressure until the balloon so formed bursts. From the radius of the balloon at rupture, the tensile strength may be calculated. It is claimed that the bursting test gives more consistent and reliable results than conventional tests.

It has been proposed to form test films both on glass and on unglazed tile. Both methods have certain objectionable features: the glass plate method requires considerable time, permitting sedimentation of fillers unless thickening is resorted to, while unglazed tiles cause the removal of part of the water soluble compounding ingredients. The use of a glass plate carrying a thin layer of coagulant greatly facilitates formation of a uniform test sheet; washing after initial drying serves to remove the traces of coagulant.

Wohler *(89)* found that surface cracks which sometimes develop are due to the zinc oxide content and may be prevented by addition of 1% Aquarex D, alone or in combination with casein. He also found that maximum tensile values were obtained when drying of the filler was done at zero humidity, an observation in agreement with those of other investigators *(90)*.

Methods for determining various compounding ingredients are of great practical importance. Qualitative or quantitative determination of triethanolamine *(88)* accelerators, antioxidants, sulfur, zinc oxide and stabilizers have been described in the literature.

BIBLIOGRAPHY

(41) Piddlesden, *Jour. Rubber Res. Inst. Malaya*, **7**, 115, 169 (1937).
(42) Crockett, U. S. P. 2,122,232.
(43) B. P. 465,226.
(44) B. P. 490,781.
(45) *Trans. Inst. Rubber Ind.*, **13**, 30 (1932); *India Rubber Jour.*, **93**, 524 (1937).
(46) "Proc. Rubber Tech. Conf.," London, 1938, 126.
(47) "Proc. Rubber Tech. Conf.," London, 1938, 81, 85.
(48) B. P. 476,073; Rubber Res. Inst. Malaya, Ann. Reports, 1935, 1936.
(49) B. P. 492,030; *Rubber Age (N. Y.)*, **41**, 237 (1937).
(50) Kratz, *Koll. Zt.*, **80**, 33 (1937).
(51) B. P. 433,303.
(52) Metallges. A. G., B. P. 461,216.
(53) S. S. Pat. 1907.
(54) B. P. 478,406.
(55) *Rubber Age (N. Y.)*, **42**, 305 (1938); *Jour. Soc. Chem. Ind.*, **58**, 116 (1939).
(56) Noble, "Proc. Rubber Tech. Conf.," London, 1938, 131.
(57) DeVries, *Rubber Chem. & Tech.*, **12**, 176 (1938).
(58) Metallges. A. G., B. P. 455,674.
(59) Kemp, *Ind. Eng. Chem.*, **29**, 643 (1937).
(60) Boggs, Blake, *Ind. Eng. Chem.*, **28**, 1198 (1936).
(61) U. S. P. 2,033,276 (1936).
(62) Daniel, *India Rubber World*, **101**, No. 4, 58 (1940).
(63) Campbell, *Chem. and Ind.*, **56**, 557 (1937)
(64) Dean, *Chem. and Ind.*, **56**, 556 (1937).
(65) Wilkes, Wickert, *Ind. Eng. Chem.*, **29**, 1234 (1937).
(66) Jordan, "Proc. Rubber Tech. Conf.," London, 1938, 111.
(67) S. S. Pat. 1707.
(68) B. P. 482,677.
(69) "Proc. Rubber Tech. Conf.," London, 1938, 197.
(70) B. P. 454,738.
(71) *Trans. Inst. Rubber Ind.*, **13**, 453 (1938).
(72) B. P. 490,905.
(73) *Ind. Eng. Chem.*, **30**, 826 (1938).
(74) *Kaut.*, **13**, 131, 159 (1937); *Rubber Chem. & Tech.*, **11**, 60 (1938).
(75) U. S. P. 2,096,609.
(76) Coker, Davey, *Rubber Chem. & Tech.*, **11**, 459 (1938); *Trans. Inst. Rubber Ind.*, **13**, 368 (1938).
(77) Murphy, "Proc. Rubber Tech. Conf.," London, 1938, 151; *Rubber Chem. & Tech.*, **12**, 883 (1939).
(78) Report of Crude Rubber Committee, Division of Rubber Chemistry, *Ind. Eng. Chem. (Anal. Ed.)*, **11**, 593 (1939); *I. R. W.*, **101**, No. 4, 47; No. 5, 51 (1940).
(79) Fowler, Thompson, *Rubber Age (N. Y.)*, **46**, 224 (1940).
(80) "Proc. Rubber Tech. Conf.," London, 1938. 169.
(81) v. Dalfsen, *Arch. Rubbercultuur*, **21**, 1 (1937).
(82) Noble, "Latex in Industry," 1936.
(83) Jordan et al, *Ind. Eng. Chem. (Anal. Ed.)*, **9**, 182 (1937).
(84) Kedrov, *Rubber Chem. & Tech.*, **12**, 112 (1939).
(85) Bachle, *Kaut.*, **12**, 210,232 (1936).
(86) Deribere, *Rev. gen. caout.*, p. 23 (Feb., 1937).
(87) *Trans. Inst. Rubber Ind.*, **12**, 367, 1937; *Rubber Chem. & Tech.*, **10**, 584 (1937).
(88) Eastland et al, *Analyst*, **62**, 261 (1937).
(89) *Ind. Eng. Chem. (Anal. Ed.)*, **9**, 117 (1937).
(90) MacKay, *Ind. Eng. Chem. (Anal. Ed.)*, **10**, 57 (1938).

(Part III, in which applications of latex are discussed, will appear next month.)

Flame-Proofing Agent for Textiles

CHLORINATED rubber is now being used as a flame-proofing agent for textiles, according to an article in the January 12, 1940, issue of *The Textile Weekly*. In view, however, of the possibility of some decomposition occurring on prolonged exposure to sunlight and dampness, the risk of more or less serious tendering of fabrics cannot be entirely excluded. One method of avoiding this danger consists in blending the chlorinated hydrocarbon (rubber, paraffin wax, vinyl resin, etc.) with a water-insoluble salt which does not evolve oxygen when heated and is fusible at the combustion temperature of the treated fabric. Chemicals satisfying these requirements are certain insoluble salts of boric acid, such as manganese and zinc borates. Further protection of the chlorinated hydrocarbon against premature decomposition is provided by inclusion of pigments, such as iron oxide, etc.

The proportion of proofing agent to fabric will vary with the type of fabric involved, according to the article. On cotton duck, for instance, it should preferably not exceed the weight of the cotton itself, but a larger proportion is permissible on more open fabrics. Satisfactory flame-proofing with retention of elasticity, strength and flexibility is said to be obtained when using proportions of ingredients ranging within the following limits (calculated upon the weight of the fabric): chlorinated hydrocarbon, 8 to 50%; borate, 1 to 30%; and pigment, 4 to 40%.

Editorials . . . . . .

Economic Effect of Buna Rubber

EVER since the announcement that the Standard Oil Company of New Jersey had acquired the rights to the manufacture of Buna rubber in the United States from I. G. Farbenindustrie, A.G., of Leverkussen, Germany, rumors have been rife as to what action the American company would take. Two things now seem to be evident: (1) The Standard Oil Company of Louisiana, a wholly-owned subsidiary of Standard Oil of New Jersey, will construct a factory for the manufacture of Buna at Baton Rouge; (2) Firestone has taken a license to manufacture Buna in its own plant for its own use.

According to Standard Oil's announcement, the Baton Rouge plant will be put in operation before the end of the year and will have a capacity of 10,000 pounds per day. On a six-day week basis, this adds up to slightly more than 1,400 long tons per year, or approximately one-quarter of 1% of crude rubber consumption in the United States on the basis of the 577,591 tons consumed in 1939. Figuring that Firestone will match the output of the Baton Rouge plant, the combined output would be only one-half of 1% of present crude rubber consumption.

It is evident from these estimations that Buna will not be a very important factor in the domestic rubber supply for some time to come, nor will the total annual output on the basis of present estimates add materially to the total supply of so-called synthetic rubbers manufactured in the United States which is now placed at approximately 1% of annual crude rubber consumption. As has been previously pointed out, while the supply of so-called domestic synthetic rubbers could of course be stepped up considerably in the case of emergency, it would take at least three or four years before sufficient production facilities could be put into operation to supply anywhere near the domestic demand for rubber.

There is little doubt that Buna rubber, due to American ingenuity, invention and raw materials, can be made more cheaply in this country than it can abroad. There is a big doubt, however, whether it can be made to sell as cheaply as some of its enthusiasts predict, *i.e.*, 15 to 20 cents a pound. As a class, the raw materials used in the manufacture of Buna have not been low priced among organic chemicals. In any event, once supplies of Buna are made available to the rubber manufacturers, the price of synthetic rubbers in general will probably be less than it is at present.

Shipments of Rubber

WHEN hostilities between the British and Germans broke out last September, many American observers expressed the belief that far-reaching shifts in this country's rubber supply sources would follow. The primary belief was that we would have to rely to a greater extent on crude rubber shipped from the Dutch East Indies instead of from British Malaya. Figures for the first six months of the war, however, fail to substantiate this belief.

Since the start of the war British Malaya has supplied America with 67.3% of its crude rubber on a monthly average basis, as compared with an average of 63.9% for the first eight months of 1939. The only noteworthy shifts in world rubber shipments since the outbreak of hostilities are a decided drop in British Malaya's percentage share in rubber shipments to Japan and Europe and a sharp increase in re-exports from the United States to Europe. Due to governmental pressure, re-exports of rubber from this country to Europe, or to any other continent, have resumed normal proportions in the past month or so.

CURRENT NEWS OF THE MONTH

"RUBBER OF TOMORROW" IS DISCUSSED BY DR. CADWELL

Participating in a symposium of New Materials in Transportation, the technical feature of the Spring Meeting of the American Society for Testing Materials, held in Detroit, Mich., on Wednesday, March 6, Dr. S. M. Cadwell, Manager, Tire Development Department, U. S. Rubber Co., Detroit, discussed "Rubber of Tomorrow." Seven technical papers in all, each delivered by prominent authorities in the fields of rubber, steel, road materials, fuels, etc., comprised the symposium.

In presenting his paper, Dr. Cadwell demonstrated certain tests in the course of it to illustrate some of the properties of newer products in the field of rubber. For instance, he showed a sample of natural rubber and one of neoprene which had been in gasoline for a week at room temperature. The one made of rubber had increased approximately 114 per cent in weight, the neoprene only about 12 per cent. Special advantage can be taken of its resistance to oil absorbing tendencies.

Indicates Oscillation Fallacy

He pointed to a fallacy that in vibrating or oscillation it seemed evident that a piece of rubber would last longest if it returned to the condition of zero strain during each cycle, but that in some cases this is the worst possible choice of conditions. In one example, starting with the rubber under a minimum extension of about 200 per cent resulted in a dynamic fatigue life at least one hundred-fold greater than when the minimum strain was zero.

Dr. Cadwell stressed that the newer synthetic-like materials are not synthetic rubber, but they can be made to resemble rubber in physical and chemical behavior. What the scientists are doing is not building a laboratory replica of nature's rubber tree, but shaping specific molecules to meet specific needs. He described cellular rubber which has the individual pores or cells walled off from each other.

After mentioning other products, Dr. Cadwell discussed the pneumatic tire which is still the major use of rubber in transportation and commented on the increasing use of rayon tire cord, which, he said, shows that the chemist and engineer need not try to imitate nature but can, through a direct attack on the molecular structure, build up a material to suit a particular need.

Rubber Heels Popular

The comfortable and stylish rubber heel is far and away the most popular single footwear item, according to statisticians of the B. F. Goodrich Co., manufactures totaling approximately 295,000,000 pairs annually. This was revealed from a survey conducted by the company during the shoe industry's celebration of National Shoe Check-Up Week. It was also pointed out that some 20,125,000 pairs of arctics and gaiters are slipped onto U. S. feet during a year.

NEW FIRESTONE TIRE PLANT TO BEGIN OPERATIONS SOON

The latest manufacturing unit of the Firestone Tire & Rubber Company will begin operations shortly at Sao Paulo, Brazil. This will be the eighth factory built by the company in foreign countries and the second to be established in South America. Other Firestone plants abroad are located in Canada, England, Spain, Switzerland, Argentina, South Africa and India.

The Brazilian plant, which occupies 20 acres, will have an initial capacity of 500 tires and tubes a day. The building is of special concrete construction and is said to provide maximum lighting and ventilation. It will be equipped with the latest type of manufacturing equipment.

Firestone has had a sales distributing organization in Brazil for the past twenty-two years. The demand for the company's products is said to have increased to the point in recent years where the erection of a local plant became necessary to provide more economical facilities and better service. The high protective tariff in Brazil was also a factor in the decision to establish a factory.

Forms Industrial Chemicals Firm

William B. Lawson, formerly of the Harshaw Chemical Company and the International Nickel Company, has announced the formation of W. B. Lawson, Inc., to deal in industrial chemicals, oils, and non-ferrous metals. Offices of the new company are in the Union Commerce Building, Cleveland, Ohio.

LOS ANGELES RUBBER GROUP HEARS TALKS ON GOLF BALLS

Approximately 100 members of the Los Angeles Group, Rubber Division, A.C.S., heard a three-angle discussion of golf and golf ball manufacture at a meeting of the group held on April 2 at the Mayfair Hotel in Los Angeles when Al Rocklen, general manager of the Golden State Rubber Mills, and two aides, staged the major part of the evening's program.

Assisting Mr. Rocklen with this part of the program were John Duncan Dunn, world authority on golf, the man who sold John D. Rockefeller his first golfing outfit and started him off on a career of long life, and E. G. Brooks, technical advisor on golf ball manufacture and an expert on golf and golf technique.

Mr. Dunn dressed in characteristic Scotch kilties, gave a history of the game and exhibited "golf balls through the ages," one ball shown being approximately 150 years old. "Golf began its real record of progress and move toward general popularity," said Mr. Dunn, "when rubber was introduced into golf ball manufacture."

Problems of Golf Ball Manufacture

Mr. Rocklen told of some of the problems of entering the golf ball manufacturing field, problems of marketing and distribution, and in a broad way some of the detailed technical problems of manufacture. Mr. Brooks went into details of manufacture and details of golf ball construction, told the "why" and the "how" of each operation, and gave a hint of progress ahead.

The second half of the program was staged by representatives of the General Electric Company, J. A. Corlett showing the industrial moving picture entitled, "More Goods for More People with Automatic Control."

Table favors, consisting of a pound of Ben Hur coffee in a glass container, came from D. Hecht and Company through their representative, Fred Ehrlich. As a door prize H. Muehlstein & Co., through their representative, Charley Churchill, donated an electric clock, which was won by Carl E. Stentz. The special prize, a brief case donated by the C. P. Hall Company through their representative, Fred Woerner, was won by E. H. Lewis. Al Rocklen conducted a golf ball guessing contest as the result of which boxes of colored golf balls were won by Dr. R. B. Stringfield and Dr. E. W. Schwartz.

DIVISION OF RUBBER CHEMISTRY HOLDS MEETING IN CINCINNATI

Cincinnati, Ohio, April 12 (By Special Wire)—The Spring Meeting of the Division of Rubber Chemistry, held here at the Hotel Gibson in conjunction with the 99th Meeting of the American Chemical Society, ended today with an attendance of over 250 at the two-day technical sessions and 300 at the banquet.

Ten papers were presented at the technical sessions, which were held yesterday afternoon and this morning. Complete abstracts of all these papers appeared in the March issue of RUBBER AGE. At the conclusion of the technical sessions, a short business meeting was held at which a number of important decisions reached by the Executive Committee of the Division were made public by Chairman E. B. Curtis, as follows:

(1) A Papers Committee has been appointed to report on changes in the rules for submission and publication of papers. (2) A committee to study and report on a number of recommended changes in the method of electing officers will be formed. (3) Endorsement has been given to the formation of a rubber group in Buffalo which is being organized by B. W. Wetherbee of the Globe Woven Belting Co. (4) A complete list of the members of the Division will be published in the July, 1940 issue of *Rubber Chemistry and Technology.*

Committee Reports Given

In addition a number of committee reports were made. The Auditing Committee reported that it had found the Division's books in satisfactory order; the Membership Committee that it had added 50 new members; the Planning Committee that it was considering holding symposiums; the Goodyear Hall of Fame Committee that it had submitted facts and data on Charles Goodyear to the Hall of Fame electors and expected favorable action this fall. The meeting was concluded by Mr. Curtis after thanking the members for their attention and the speakers for their excellent presentations.

The banquet held last night in the Roof Garden of the Gibson Hotel was the usual enjoyable affair. The program was in the hands of V. L. Smithers, Enos Baker and A. C. Eide. Strolling singers enlivened the proceedings before dinner. J. Elder Blackledge, well-known magician, later entertained the diners with a number of mystifying feats, including the rope trick, Chinese rings, etc. Dr. C. L. Parsons, secretary of the A. C. S., and Chairmen Lewis, LaPorte, Haynes and Walton, of the Chicago, Akron, New York and Boston rubber groups, were all in attendance and were introduced in turn by Chairman Curtis. The Cincinnati Section of the A. C. S., through Chairman Procter Thomson, made a substantial contribution to the entertainment program, and acknowledgement was made of its welcome assistance.

In addition to the scheduled papers an extensive report of the Crude Rubber Committee was made by the new Chairman, George Sackett, of Goodyear, supplemented by a report of E. W. Oldham, of Firestone, on specifications for washing tests to determine the amount of dirt allowable in various grades of crude rubber.

Mr. Sackett said the committee was five years old and that it now consisted of seven instead of five members with seven alternates. He reviewed the activities of the committee and stated that he was pleased with the general adoption here and abroad of a standard recipe for testing rate of cure. Other accomplishments cited were tentative methods of analysis of crude rubber for copper and manganese, procedures for testing latex, plasticity of crude rubber, and studies on age resistance and foreign matter in rubber.

He reported that the full committee had met in January and that the following subjects had been discussed: *Plasticity*—Definite procedures to be offered soon; *Latex Testing*—Tentative procedures have been published and mechanical stability tests were discussed with definite procedures to be presented this fall; (3) *Packing*—Treated Hessian fabric found to be superior to wooden cases but not completely satisfactory, while the use of a rubber wrapper was felt to be a distinct advance; (4) *Sampling*—No standard procedure is ready yet but studies are being continued.

(5) *Age Resistance*—Conflicting data of earlier studies will require further study of the subject and it is hoped to be able to develop a recipe to show variations in age resistance and to propose an accelerated test; (6) *Rate of Cure*—This can be judged by using definite properties at any of the specified cures. It was suggested that if the rate of cure is to be compared to a standard cure and modulus, that these be the cure at 40 minutes at 126° C. and modulus of 700%; (7) *Determination of Foreign Matter*—Comparing a sample of rubber with a given standard is not completely satisfactory nor is the method of dissolving a 20 gram sample in benzol, then filtering and washing with solvent and weighing the unfiltered residue.

Another method based on factory procedure was offered for consideration. This method was described by E. W. Oldham and consists essentially of cutting 50 pounds from each of 20 bales of rubber of each carload and washing the samples by the so-called hand method on flushed cracker and washer. A 50-mesh screen with openings of 1/100th of an inch is placed in the fan underneath the rolls. After the batch is passed through the washer six times the tank enclosing the washer is flushed and the screen removed.

Screenings are then dried and weighed to determine the total amount of dirt which consists of sand splinters, straw bark and iron scale. The organic matter is then ignited and the balance is covered with concentrated hydrochloric acid to dissolve any iron scale from the washer. The residue is washed by decantation, dried in an oven, and then weighed to determine the amount of sand and other non-volatile dirt present. The speaker then gave results of tests showing amounts of total dirt, volatile matter and sand found in samples of smoked sheets, brown crepe and amber blankets.

Stanley W. MacKenzie, Division Purchasing Agent, Mechanical Goods Division, United States Rubber Co., Passaic, N. J., speaking at the Packing and Shipping Clinic, held on Thursday, March 25, as part of the American Management Association's Tenth Annual Packaging, Packing and Shipping Conference. Mr. MacKenzie is discussing a new type of hose reel. Shown here is the reel, with and without the hose.

PLASTIC SYMPOSIUM HELD BY BOSTON RUBBER GROUP

A symposium on plastics, which included five speakers and a sound film on safety glass which incorporates a plastic bonding medium, featured the meeting of the Boston Group, Rubber Division, A.C.S., held at the University Club, Boston, on Friday, April 5. Approximately 285 members and guests were in attendance, one of the largest turnouts ever experienced by the group.

The first paper in the symposium, which was designed to indicate to the rubber chemists and technologists how plastics can be used with rubber or in place of rubber, was delivered by Professor Charles E. Reed of the Chemical Engineering Department of the Massachusetts Institute of Technology, under the title "General Nature and Properties of Synthetic Plastics." Dr. Reed stated at the outset that there were two distinct classes of plastics, natural and synthetic, and two distinct types, thermosetting and thermoplastic.

Internal Structure of Plastics

By means of simple charts, of the type used in teaching fundamental organic chemistry, Dr. Reed illustrated the internal structure of the thermoplastic and thermosetting plastics. He explained how the specific properties of each class of plastics were secured by chemical reaction of the basic materials, but did not attempt to discuss the application of these properties to finished products. As he explained, Dr. Reed's address was intended to serve as a background for the technical papers to be presented.

The first of the technical papers was on "New Developments in and Applications of Plasticized Vinyl Resins," delivered by J. R. Price, technical staff, Carbide and Carbon Chemicals Corp. He first explained that Vinylite is thermoplastic in nature, has rubber-like properties, and can generally be handled by the same type of machinery used for the compounding of rubber, although unlike rubber it needs no curing. Its properties of resistance to acids and alkalis, flexing, elasticity, etc., depend largely on the plasticizers incorporated in the mix.

Mr. Price then discussed molding, calendering and extrusion procedures for the vinyl resins, and stressed the various modifications which must be made on present day rubber machinery in these operations. Launching into a discussion of the applications of these resins, he stated that they were fast being adopted for use on telephone and telegraph wires and cables because of their high insulation value. He also pointed out that they can be bonded to rubber by means of adhesives or, in some cases, by heat sealing.

In concluding his talk, Mr. Price made it clear that Carbide and Carbon considers its vinyl resins as supplementary materials to rubber rather than competitive materials. He also stated that one of the difficulties of using the resins at present is the fact that as yet their thermal life is somewhat limited. In connection with his talk, Mr. Price exhibited a number of articles made from the new resins, including suspenders, garters, belts, shoes, bedroom slippers, etc.

"Cellulose Derivative Plastics" was the title of the next paper. Delivered by W. E. Gloor of the Hercules Powder Co., Wilmington, Delaware, the point was early brought out that the cellulose derivatives are competitive to rubber and in many cases, particularly combs and automobile steering wheels, had replaced rubber products. Mr. Gloor traced the history of the cellulose derivatives, discussed various injection molding methods, and displayed a number of slides depicting the many types of molding presses currently used. He also stressed the advantages of these plastics over other types of plastics, and revealed a few disadvantages in certain applications.

The speaker, by means of charts, indicated the several different cellulose derivatives, and briefly discussed the inherent properties of each. Ethyl cellulose, he said, can be formulated to give tougher compounds than the other types. As an example of this, he told of the use of ethyl cellulose in making compounds for the coating of blasting cap wire which must stand the wet, abrading conditions present in mines and quarries and yet be readily spliced into other circuits in a short time. The coating, he explained, is applied as a hot melt by means of a modified Royle tuber. Another use of ethyl cellulose is its combination with Paraplex RG 2, a proprietary resin, to give a lacquer adherent to rubber sheet.

Discusses Acrylic Resins

W. F. Bartoe, of the Rohm & Haas Co., Philadelphia, Penna., next discussed "Some Interesting Properties of Acrylic Resins." This paper was largely devoted to a discussion of physical and chemical tests applied in conjunction with the acrylic resins. The speaker showed slides of the regular and special apparatus used in tests for sunlight exposure, tensile, stress, strain, etc., and then additional slides indicating the results of these tests. The point was made that whether molded or extruded, the acrylic resins exhibit a crystal clear transparency, a feature which encourages their use in certain applications. One unusual factor of the acrylic resins, it was stressed, is the fact that they recover their original properties after numerous heatings.

The final paper in the plastics symposium was that on "Polybutene in Rubber Compounds," by L. B. Turner, Standard Oil Development Co., Linden, N. J. Mr. Turner first discussed preliminary experiments conducted to determine the effect of polybutene additions on the aging and physical properties of simple rubber stocks. He then discussed the production and properties of polybutene and said that two grades were now available, having molecular weights of 12,000 to 15,000 and 80,000 to 120,000, respectively, the elastic property of the polybutenes depending upon the molecular weight, those having weights below 18,000 to 20,000 being viscous liquids. Above 25,000 to 30,000, the product begins to assume rubber-like properties.

Polybutene-Rubber Compounds

Mr. Turner then launched into a discussion of procedures to be followed in incorporating polybutene in rubber compounds, and warned that experience in rubber compounding does not necessarily apply to rubber-polybutene blends. He talked of milling, breakdown of the rubber, amount of sulfur to be used, amount of accelerator to be incorporated, etc. He also stated that the polybutenes need plasticizers but that not a great deal of work has been done in this direction.

The speaker then went into some detail on the effect of polybutene on rubber compounds and showed several slides giving results of tests of various compounds, the tests indicating that the incorporation of polybutene gives improved resistance to aging, chemicals and moisture penetration. In summarizing the data presented, Mr. Turner said that it seems reasonable to conclude that the polybutene not only surrounds the rubber structure, thereby protecting it, but at the same time fills the interstices, thereby preventing water or gases from penetrating into the compound.

Before dinner was served at the meeting, a film on safety glass, prepared by the Safety Glass Association, Inc., was presented. It showed the advantages of laminated glass, which uses a plastic sheet as the bonding medium, over ordinary or case hardened glass. Just prior to the beginning of the symposium on plastics, James Walton, of the Boston Woven Hose & Rubber Co., chairman of the group, announced that Charles Reid Boggs, vice-president and general manager of the Simplex Wire & Cable Co., a founder and former chairman of the group, had died on April 1. He read a commemorative memorandum, at the conclusion of which the members and guests stood in silent tribute to the memory of Mr. Boggs.

Coming Events

May 7. Los Angeles Rubber Group, Hotel Mayfair, Los Angeles, Cal.

May 13-15. American Institute of Chemical Engineers, Hotel Statler, Buffalo, N. Y.

July 19. Boston Rubber Group, Annual Outing.

Sept. 9-13. American Chemical Society, 100th Meeting, Detroit.

Oct. 7-11. National Safety Congress, Stevens Hotel, Chicago, Ill.

A.S.T.M. RUBBER COMMITTEE HOLDS MEETINGS IN DETROIT

Committee D-11 on Rubber Products of the American Society for Testing Materials held 15 sub-committee meetings and one main session during A.S.T.M. Committee Week in Detroit, Mich., from March 4 to 8. Action was taken with respect to a number of important recommended changes to be made to the Society.

Several new specifications and tests were approved for submission to letter ballot, including procedures for testing hydraulic brake hose developed by Technical Committee A on Automotive Rubber. A new section is being organized to investigate the suitability of tests of hose used in automotive cooling systems (heater and radiator). The methods for examination of all types of rubber hose (D-380—39T) will continue as tentative with a revision involving test conditions for hydraulic tests for high-pressure hose.

Some Recommended Changes

Changes are to be incorporated in the methods of testing flat rubber belting (D-378—39T) involving shape of specimen for the tension test requirements, the measurement of thickness, and the direction of taking test specimens. A kerosene-benzol swelling test is to be added for use especially in connection with belting intended for conveying products which might require an oil-resistant belting.

Specifications covering three types of insulated wire and cable, D-27—39T, D-353—39T, and D-469—39T, will be slightly revised taking into consideration metallic coatings other than tin on the wire. Certain changes will also be embodied in the size of minimum conductors. Of particular interest in this field are proposed new specifications covering ozone resisting type of wire insulation.

The sub-committee concerned with abrasion is developing standardized procedures involving tearing and cutting as methods of determining resistance to punching and related characteristics. It is probable that the existing Tentative Methods of Test for Abrasion Resistance of Rubber Compounds (D-394—37T) will be suggested for adoption as standard.

In the work on aging, an accelerated light aging procedure using artificial light has been practically completed and will be submitted at the next meeting of Committee D-11. The present tests for accelerated aging of vulcanized rubber (D-428—36T), classified as the air-oven and oxygen-pressure-chamber methods, will be changed editorially, the two methods being separated and issued as separate standards. Also, a more highly accelerated test for aging has been developed, one which will conduct the test at 80° C.

The existing Tentative Methods of Test for Compression Set of Vulcanized Rubber (D-395—37T) are to be revised, the major change involving construction of the apparatus for set under constant load.

Technical Committee A on Automotive Rubber has developed proposed testing procedures for load deflection of rubber in compression which were approved by Committee D-11.

The sub-committee concerned with rubber products for absorbing vibration examined four hand-operated hardness testing machines as developed by different manufacturers, this being done at the request of Technical Committee A. In order to develop further data the machines will be circulated among the members for experimental use.

New methods of test for compression flexing (compression hysteresis and heat build-up) will be available in time for inclusion in the annual report of the committee to be presented at the Society's Annual Meeting in June. These will probably be recommended for publication as tentative. The methods will involve the use of flexometers developed by St. Joseph Lead, Firestone, and Goodrich.

The committee on tests of liquid rubber products, which is a rapidly developing field, discussed proposed methods of test for latex. Investigative studies are under way and will probably be reported to the main committee in June.

In the field of hard rubber an extended cooperative test program will be undertaken immediately to evaluate present methods of tests. Twelve cooperating laboratories will carry out carefully prescribed tests on three different hard rubber compounds. One of the purposes of this work is to develop any defects in the present methods and also to bring to light improvements in the procedures.

Technical Committee A on Automotive Rubber, which functions as a joint committee of the Society of Automotive Engineers and the A.S.T.M., prepared specifications for first grade motor mounting compounds classified by physical properties. These have been referred for approval to the Standards Committee of the S.A.E. Also recommended to the S.A.E. standards group are proposed specifications for hydraulic brake hose.

Because there are a number of problems involving the use of rubber in the automotive field, which might be solved most effectively by joint cooperation of the industries concerned, consideration is being given to the possibility of establishing a foundation for scientific research. Involved problems could be investigated through such a set-up.

AKRON RUBBER GROUP HEARS SPEAKER AND ELECTS NEW OFFICERS

H. V. Powers

L. V. Cooper

Captain Garland S. Fulton, head of the Airship Section of the Bureau of Aeronautics, United States Navy, Washington, D. C., a leading authority on airship design, was the principal speaker at a meeting of the Akron Group, Rubber Division, A.C.S., held at the Akron City Club on March 29. Approximately 210 members and guests attended.

Taking as his topic "Airships—Principles, Practices and Problems," Captain Fulton, who was introduced by Congressman Dow Harter, sketched some of the current problems facing lighter-than-air craft and staunchly defended their place in the defense mechanism of this country. He attributed some of the airship disasters of past years to mechanical defects and stated that important lessons were learned from them which could be incorporated in new ships.

Following this address, an election of officers was held with the following results: *Chairman:* H. V. Powers (Goodyear); *Vice-Chairman,* L. V. Cooper (Firestone); *Secretary-Treasurer,* T. L. Stevens (C. P. Hall). Mr. Powers has been associated with Goodyear since 1916, starting as a tire finisher, and for the past several years has been in the research division in charge of the compounding section. Mr. Cooper joined Firestone in 1922 as a research compounder and in recent years has been in charge of physical testing. Mr. Stevens has been with C. P. Hall for many years and is well known to rubber manufacturers in and around Akron.

FINANCIAL NEWS

American Cyanamid Company

For 1939: Net income of $5,524,940 after charges and taxes, equal to $2.07 each on 2,618,367 combined Class A and Class B shares outstanding after preferred dividend requirements. This compares with $2,452,911, or 91c a share, in the preceding year. The balance sheet shows current assets of $39,445,229 against current liabilities of $9,040,125, which compares with $33,653,471 and $5,513,595, respectively, at the end of 1938.

Columbian Carbon Company

For 1939: Net profit of $2,857,103 after depreciation, depletion, loss on disposed fixed assets, Federal income taxes, minority interest, and other charges, equal to $5.32 each on 537,406 shares of no-par capital stock. This compares with $2,757,540, or $5.13 a share, earned the year before. The company's carbon black sales in 1939 exceeded those of 1938 by $1,277,511, according to a statement by F. F. Curtze, president.

Garlock Packing Company

For 1939: Net income of $1,004,585, after interest, taxes and other charges, equal to $4.80 each on 209,250 shares of capital stock, which compares with $544,482, or $2.60 a share, in the previous year. The company will call for redemption on May 31 the balance of its 4½% convertible notes, series of 1936, amounting to approximately $198,000.

Flintkote Company

Year Ended March 23: Net income of $1,444,207, equal to $2.13 each on 678,546 shares of stock outstanding, which compares with $910,915, or $1.35 a share, in the previous year. Net sales for the year ended March 23 were $17,444,915 as compared with $15,164,642 at the end of the preceding year.

Mansfield Tire & Rubber Co.

For 1939: Net income of $501,796, after charges for Federal taxes and depreciation, equal to $2.99 a share on 157,400 shares of common stock outstanding. This compares with $458,455, or $2.70 a share, in 1938, and $340,754, or $2.24 a share, in 1937.

National-Erie Corporation

For 1939: Net profit of $33,878, after allowing $54,718 for depreciation. The balance sheet as of December 31 shows current assets of $497,614 against current liabilities of $112,378. Total assets of the company are listed at $1,145,737.

Anaconda Wire & Cable Co.

For 1939: Net income of $648,899, after all charges, equal to $1.53 each on 421,981 shares of common capital stock, contrasted with a loss of $97,781 reported for 1938. Current assets as of December 31 amounted to $11,132,047 against current liabilities of $2,357,828, which compares with $10,364,790 and $2,619,233, respectively, at the end of the preceding year.

Master Tire & Rubber Corp.

For 1939: Net profit of $223,867, equal to $1.49 a share after allowance for a full year's preferred dividends. This compares with a profit of $135,177 reported for 1938. Current assets as of December 31 amounted to $825,910 and current liabilities to $357,341, which compares with $715,527 and $376,309, respectively, at the end of 1938.

National Rubber Machinery Co.

For 1939: Net income of $102,331, equal to 66 cents each on 154,000 common shares, which compares with $47,062, or 31 cents a share, in 1938.

Collyer Insulated Wire Co.

For 1939: Net income of $33,579, equal to 22 cents each on 150,000 capital shares, which compares with a net loss of $62,473 reported for the previous year.

Announce Fifth Colloidal Course

The Fifth Special Summer Program in Theoretical and Applied Chemistry and Physics of Matter in the Colloidal State will be given by the Department of Chemical Engineering of the Massachusetts Institute of Technology, Cambridge, Mass., for five weeks, beginning June 17. The special course will again be under the direction of Dr. Ernst A. Hauser. Like previous courses, it will consist of lectures, round-table discussions, practical training in laboratory and research work, and is intended for those actively engaged in industry or research.

Canadian Association Moves

Offices of the Rubber Association of Canada have been moved from the Harbour Administration Building, Toronto, to the Commerce and Transportation Building, also in Toronto. The latter building is located at 159 Bay Street. A. B. Hannay is manager and secretary of the Association.

STANDARD OIL MAY BUILD BUNA PLANT AT BATON ROUGE

It is reported on reliable authority that the Standard Oil Development Company has reached an agreement with the Standard Oil Company of Louisiana under which the latter company will construct a factory at Baton Rouge for the manufacture of Buna rubbers. The plant, which is expected to have a daily capacity of 10,000 pounds, may begin operations by the latter part of the current year. Both companies involved are wholly-owned subsidiaries of the Standard Oil Company of New Jersey.

According to the same report, the Firestone Tire & Rubber Company has taken a license from the Standard Oil Development Company, which recently acquired the rights to the manufacture of Buna in this country from I. G. Farbenindustrie of Germany, to manufacture its own Buna requirements. Production of Buna in the Firestone plant is expected to get under way in the near future. Shortly after Standard Oil acquired the rights to Buna manufacture in this country, it was announced that the company was negotiating with several large rubber manufacturers to have them accept licenses to produce their own supplies.

Still another report has it that another leading rubber company already has informed Standard Oil that it will draw its supplies of Buna from the proposed factory in Baton Rouge. A survey of the larger rubber manufacturers revealed no definite information, but Goodyear is believed to be the "other leading company" in question.

U. S. Rubber in New Home

On March 29 the job of moving the United States Rubber Company from its old building at 58th Street and Broadway to its new home at 1230 Sixth Avenue in Rockefeller Center, New York City, was started. More than 400 truck trips were required in all to transplant the organization, the complete job being completed over the week-end. According to moving experts, the task was the largest business office move in New York in the past five years, and the 40 working hours in which the move was made is said to have set a record. All divisions of the company formerly housed in the old building on Broadway are now located at the new address.

Raise Original Tire Prices

An increase of 2½ to 7% in original equipment tire prices to automobile manufacturers, effective April 1, was announced last month by several major tire companies, including Goodrich and Firestone. The increase in these prices is the first made since the middle of 1937, the action being necessitated by increases in the cost of raw materials. Original equipment tires account for approximately 40% of annual tire production

NAMES IN THE NEWS

H. D. TOMPKINS, who has served with the Firestone Tire & Rubber Company in various sales capacities for the past 21 years, has been appointed sales manager of that company with headquarters at Akron. Since 1935 he has been sales manager of the Firestone Company of California.

EMMET SHEAHAN, who was appointed general manager of the Automotive Division of the U. S. Rubber Company a year ago, has been advanced to the post of general manager of the Tire Division. In connection with his new duties, MR. SHEAHAN was elected president of the U. S. Tire Dealers Corporation, succeeding L. D. TOMPKINS in that capacity.

KENNETH VANDERBREE, advertising manager, John Royle & Sons, Paterson, N. J., was married on Wednesday, March 27, to MISS CORINNE VERDUIN.

C. A. HEMINGWAY, with the sales department of Wishnick-Tumpeer, Inc., since 1922, has been appointed manager of the company's Cleveland office.

HUGH A. GALT, vice-president of the Pittsburgh Plate Glass Co., and president of the Columbia Alkali Corp., a subsidiary, retired last month after more than forty years of service with the parent company and various affiliates. He expects to devote all of his time to personal research.

A. O. SAMUELS and H. L. SAMUELS, president and vice-president, respectively, of the Samson United Corporation, resigned their positions as of April 2. The former is credited with the development of the rubber-bladed fan. H. A. POTSDAM continues as executive vice-president.

J. C. DE C. VAN ETTEN, president of Vansul, Inc., Englewood, N. J., has accepted the post of Chairman of the Outing Committee for the annual picnic and outing of the New York Group, Rubber Division, A.C.S., which will be held sometime in June.

S. W. WEIGER, president, Central Rubber Corp., Findlay, Ohio, was elected a director of the Findlay Chamber of Commerce at its annual meeting held last month.

H. J. CARROLL, general traffic manager, Goodyear Tire & Rubber Co., Akron, was re-elected president of the Great Lakes Regional Advisory Board at a meeting held in Toledo, Ohio, on March 27. The Board is composed of industrial traffic managers.

P. E. H. LEROY, vice-president, Goodyear Tire & Rubber Co., Akron, completed 20 years of consecutive service with the company last month. He joined the company in 1920, was elected assistant treasurer in 1921, treasurer in 1929, and vice-president in 1932.

ARTHUR S. FUNK, associated with the La Crosse Rubber Mills, La Crosse, Wisconsin, since 1909, has resigned as general manager of that company. He will, however, continue as a director and treasurer of the company. LEO J. LARKIN has been named general manager.

HARRY L. FISHER, associate director of research, U. S. Industrial Alcohol Co., formerly associated with the U. S. Rubber Co., was recently elected vice-president of the newly-organized Chemists Alumni Association of Columbia University.

EDWARD H. MARSH, JR., for a number of years a vice-president of the Fisk Tire Export Co., Inc., has been elected vice-president, general manager and a director of the U. S. Rubber Export Co., Ltd.

CARL L. BRICKMAN, associated with the development and research departments of the Goodyear Tire & Rubber Company for the past ten years, has joined Thomas M. Royal & Co., Philadelphia, in charge of research, testing and package development service.

J. F. EDMONDS has been elected a vice-president of the Anchor Packing Co., Philadelphia, succeeding the late GEORGE M. ADAMS.

ROBERT STONE, sales director, American Bandage Corp., Chicago; VIRGINIA YOUNG, correspondence supervisor, Gates Rubber Co., Denver; HENRY DORFF, L. E. Waterman Co., Newark, N. J., and C. A. WINSER, export division, Gates Rubber Co., Denver, have all been awarded gold medals by the editors of Dartnell Service, Chicago, for writing the best business letters of the year.

EARL H. BARDER, general superintendent, tire division, and CHESTER F. CONNER, sales promotion manager, mechanical division, B. F. Goodrich Co., were among the employees completing 30 years of service with the company last month.

A. C. WIEBE, representative of the F. J. Stokes Machine Company in the Metropolitan New York district, moved to new offices at 103 Park Avenue, New York City, last month. He represents the company on its molding equipment.

WILLIAM E. BRUYN, treasurer, Littlejohn Co., and E. S. UNDERHILL, of the U. S. Rubber Co., have been appointed chairman and vice-chairman, respectively, of the Rubber Industries Section, Industry Division, Greater New York Fund. The appointments were made by F. B. DAVIS, JR., president, U. S. Rubber Co., who is chairman of the Industry Division of the Fund.

WILLIAM M. STOCKER, associated with the Cameron Machine Co., Brooklyn, N. Y., since 1925, has been appointed chief engineer of that company.

F. A. SEIBERLING, chairman of the board, Seiberling Rubber Co., Akron, was honored at a dinner of the Lincoln Memorial University, Horrowgate, Tennessee, held in the Hotel Waldorf-Astoria, New York, last month. MR. SEIBERLING is honorary chairman of the directorate of the University.

E. A. STEVENS, crude rubber department, B. F. Goodrich Co., Akron, sailed for Singapore on March 27 to assume management of the company's crude rubber buying organization in that city. He replaces GEORGE M. NAYLOR, who is expected back in the United States shortly.

CLEM N. KOHL, controller, Gates Rubber Co., Denver, Colorado, has an interesting article on "Budgeting for Control" in the February 15, 1940, issue of the *N.A.C.A. Bulletin*, official publication of the National Association of Cost Accountants, 385 Madison Ave., New York City.

Dural Rubber Co. Incorporated

The Dural Rubber Company, Flemington, N. J., was incorporated recently for $100,000. The new firm will manufacture automotive rubber products, shoe materials, stair treads, drain boards and a miscellaneous line of mechanical rubber goods. It has purchased the factory formerly used by the old Dural Rubber Corporation, and is installing new and up-to-date machinery. Thirty to fifty workers will be employed. Robert J. Heiney is president of the new firm, Samuel J. Heiney is vice-president, and I. W. Gleason is secretary-treasurer.

Givaudan-Delawanna to Move

After May 20th the executive offices and service laboratories of Givaudan-Delawanna, Inc., will be located in the McGraw-Hill Building, 330 West 42nd Street, New York City. The move is necessary because of the growth and development of the company and its affiliates, which, as a group, is now one of the largest producers of aromatic chemicals and perfume materials in the world.

LOS ANGELES NEWS

A farewell party was given at Goodyear last month for Emmett Ross who has been transferred from the Los Angeles plant to the Goodyear plant at Cartersville, Texas, where he is now night foreman.

Lou Hochberg, formerly manager of the Flying Squadron and Goodyear Hall in Akron, spent a week in Los Angeles in March enroute to Java where he has been named division superintendent of the Goodyear plant.

The Rubbercraft Corporation of California has completed and is handing out to customers its elegant new 94-page catalog, one of the largest if not the very largest catalog of its kind ever issued in Los Angeles. Thousands of items manufactured by the corporation are listed and many hundreds of them are illustrated. The volume is handsomely bound, fine book paper is used, and the leaves are hinged with a spiral wire. Charles N. Merralls, the president, uses two pages to give his message of good will to the public.

Bob Abbott of the C. P. Hall Company, who attended the Packaging Show in New York, March 26-27-28, is spending some time in Akron, Ohio. He also visited Trenton, N. J. Mr. Abbott left Los Angeles about March 20.

Al McPherson, purchasing agent for the B. F. Goodrich Company, is spending some time in the East. Among other things, he is looking over equipment at Akron preparatory to contemplated improvements and additions to the local plant.

Dr. R. B. Stringfield, rubber chemist, who has returned from a trip in the course of which he spoke to student assemblies in 320 high schools and colleges, announces that he is offering a course in rubber technology in connection with the College of Chemical Engineering at the University of Southern California. He held his first class on Thursday evening, March 28. This course is offered every winter and usually is well attended by chemists from the various rubber manufacturing plants in Los Angeles.

E. D. Caram, president of the Caram Manufacturing Company, Inc., has installed several new pieces of equipment, including a mill, a press and a tuber. Two outside salesmen have been added to the force. The company manufactures rubber soles, rubber cement, auto accessories, and, as a side-line, shoe polish. The present address is 916 East 59th Street.

Western Insulated Wire, Inc., 1001 East 62nd Street, has completed an expansion program that gives double the capacity in three departments—bunching of copper wire, asbestos wrapping, and braiding. About 4,000 square feet of floor space have been added and three shifts are now working.

According to E. H. Lewis, vice-president and general manager, several new lines have recently been added. Among these is a line of oil well cables developed in this plant, synthetic rubber being employed in its manufacture. A line of glass fibre insulation is now being manufactured, the fibre being used in combination with rubber. A department has also been added for the assembling of various types of cords for electric appliances with rubber or bakelite caps (or plugs). Molds are now being made for the manufacture of such caps.

This company started in Jnauary, 1938, with fifteen employees. Today there are more than 60 employees and 30,000 feet of floor space is occupied. A. D. Nast, Jr., is president and the active head of the sales force. Since the European war broke out a growing export department has been established and shipments have been made to Guatemala, Salvador, Mexico, Peru, Chile, Ecuador, Argentina, and Portugal.

Dr. E. W. Schwartz, chief chemist in the merchandise department of the General Electric Company at Bridgeport, Connecticut, arrived in Los Angeles late in March to spend two weeks in the local branch.

M. C. Stone, plant foreman for the Mihm Rubber Company, 1172 E. Slauson Avenue, left on a month's vacation with his family, April 6. Most of the time is to be spent in the home town of Kansas City.

K. W. Faulhaber, president of the Faulhaber Rubber Company, 1346 East Slauson Avenue, has returned from a business trip to Montana, Utah and other western states.

P. Zuiderhoek has arrived from the Goodrich plant at Oaks, Pa., to become general foreman in charge of tire building and stock preparation in the local Goodrich plant, succeeding Harry Meiser, who has resigned. Frank Fricker has arrived from Akron as an addition to the force in the time study department.

John B. Tuberger is the new sales manager for Western Insulated Wire, Inc., succeeding Wiley Doran who has entered the radio field.

A farewell party was given on March 29 for Carl Spinning of the United States Rubber Company who left Los Angeles enroute to Buenos Aires, Argentina, where he will join F. S. Carpenter who left earlier. The two will work together in the planning of the company's new plant in that city. He was given a camera.

C. S. Ching, director of public relations for the United States Rubber Company, spent several days in the Los Angeles area recently where he addressed various groups, including the Los Angeles Chamber of Commerce, the Town Hall, the Industrial Relations Section of the California Institute of Technology, and others. He went on to Stanford University at which place he addressed the Industrial Relations Conference.

Carlisle Botkin, formerly cost accountant, has succeeded Carl Spinning as controller in the United States Rubber Company plant.

A petition for a National Labor Relations Board election among the 1,200 or more employees of the Firestone Tire and Rubber Company was filed with the Board on Monday, April 1, by the United Rubber Workers of America. Regional Board Director Walter P. Spreckels states he will endeavor to obtain company consent to the holding of the election.

Changes at Callaway Mills

Harold H. Barnard has been promoted to the managership of the New York Department of the Industrial Fabric Division of Callaway Mills. In addition, Frank S. Graves, W. C. Farley, and C. J. White, Jr., have been transferred from other divisions of the company to the Industrial Fabric Division. W. A. Drisler of that Division recently resigned to accept the position of vice-president and sales manager of the Pond Lily Co., New Haven, Conn.

New Building for Goodrich

Erection of a new one-story building in the reclaiming division of the B. F. Goodrich Co., Akron, was started last month, according to T. G. Graham, vice-president. Construction is also under way on an addition to the company's chemical plant. It is estimated that the latter addition will cost $65,000.

Hewitt Rubber Plans Expansion

Hewitt Rubber Corp., Buffalo, N. Y., has announced a $200,000 plant improvement program which will include modernization of present plant equipment and construction of a new three-story warehouse. The company has been especially active in the past several months.

MANY NEW RUBBER NOVELTIES ARE EXHIBITED AT TOY FAIR

A number of new novelties, in addition to improved patterns and designs on staple products, were exhibited at the 1940 American Toy Fair, which opened on April 1 at the Hotel McAlpin in New York City, under the sponsorship of the Toy Manufacturers of the U.S.A. Based on results in the first week of the Fair, an increase over last year's $230,000,000 toy sales is expected, a fair portion of which will fall to rubber manufacturers.

Seiberling Latex Products exhibited their new line of Pinocchio rubber characters, including Pinocchio, Figaro the Cat, Cleo the Goldfish, and Jiminy Cricket. These are made of latex or blown rubber, and come equipped with metal reed whistles. Also on display were two new latex character creations, a Baby Panda and a Whistling Clown. New sponge and inflated rubber play balls were shown, as well as sculptured play balls, featuring dog and owl faces.

Auburn Rubber featured boxed rubber sets in newly-created sales packages designed by Martin Ullman, leading package designer. These sets, which retail for 50c and $1.00, include farm animals, soldiers, blocks, baseball players, wheeled toys, artillery, etc. Included among new low-priced novelties displayed were battleships, tanks, fire engines, and train sets.

Kaysam and Toyad Show Lines

A brand new line of novelties, all made by the Kaysam Process, was shown by the Kaysam Corporation of America. These included fish, whales, elephants, hippos, ducks, pussy cats and submergible submarines. The company also showed a new line of beach balls, measuring up to 48 inches in diameter. Also displaying a brand new line of novelties, ranging in price from 25c to $1.00, was the Toyad Corporation. These novelties, made under the Firestone latex foam sponge rubber patents, included a bunny, panda, doll and Santa Claus. The line will be expanded shortly, according to one of the attendants at the exhibit.

Seamless Rubber had its complete line of toys, drug sundries and bathing specialties on display. Feature of the exhibit was the Lorelei bathing cap, a strapless aviator which fits snugly on the head and which has the patented "Aqua-Seal" ring which serves to keep the hair dry. Play balls and beach balls were also on display.

A number of new light-weight, ten-cent novelties were shown by Sun Rubber. Several rubber characters from Gulliver's Travels, including Gabby, were also on exhibit, as were other characters featured by the company, such as Oswald the Rabbit, Porky Pig, etc. Jointed dolls, with hard and soft rubber heads, were displayed, in addition to such staples as doll sets, miniature cars and airplanes, and balloons.

Latex Imports Increased

Imports of rubber latex more than doubled last year over 1938, a total of 61,000,000 pounds being imported in 1939 against 27,000,000 in the preceding year. The increase, according to the Firestone economic research division, was due principally to the increasing use of latex in the manufacture of cushioning material. It was also revealed that most of the production of Firestone's plantations in Liberia now is being shipped to the company's factories as latex rather than as sheet rubber.

Balloons of all sorts and shapes, including spiral and figure types, were displayed by Lee-Tex Products and Anderson Rubber. The former concern was especially proud of new type polychrome balloons, while the latter featured a large assortment of striking floral, animal and striped prints in two and three color combinations, in addition to toy sets which incorporate the use of balloons, such as miniature table tennis. Pioneer Rubber and Oak Rubber also exhibited balloons during the Fair, at their regular showrooms in New York. Barr Rubber, too, showed its complete balloon line, including "China Boy," a new toss-up type.

Playballs, handballs, etc., were exhibited by Pennsylvania Rubber and Barr Rubber, the former featuring balls with mottled effects, and the latter a cellophane-wrapped, gas-filled ball. Barr also displayed a suitcase set, in which is contained balls, paddles and balloons, an ideal gift item retailing for $1.00. The C. B. Webb Company had its toy line of Weaver valve balls on display.

Other rubber companies exhibiting their wares, either at the Hotel McAlpin or at their permanent showrooms, included Schavoir Rubber, which featured movable head novelties retailing for 10 cents and a new wetting doll to sell for 25 cents; Plymouth Rubber, which showed a new line of play and beach balls, and new style bathing caps; and Franklin Rubber, which displayed its rubber horse shoes and quoits.

Also of interest at the Fair was a new toy called Tony Sarg's Rubber Necks, displayed by Selchow & Righter, distributing firm. The idea is for young artists to paint in water colors through stencils on sheet rubber, the "rubber necks" starting their antics after the painting is done. Another was the Sticker Kit Flexies toy featured by Kits, Inc. A liberal supply of basic shapes die-cut from sponge rubber, designed so they will make scores of little three-dimensional "flexies," such as birds, animals, trains, etc., is supplied in a package, together with rubber cement and a large number of suggested designs.

NEW YORK RUBBER GROUP HOLDS INTERESTING MEETING

Approximately 300 members and guests attended an interesting meeting of the New York Group, Rubber Division, A.C.S., held at the Building Trades Club in New York City on Friday, March 15. Three technical papers and two sound movies comprised the program.

The first speaker was C. A. Norris of the Bakelite Corporation, New York City, who first presented a sound film entitled "The Fourth Kingdom," which traced the development of the plastics industry and depicted a large number of products, ranging from automotive gear shift caps to one-piece coffins. After the picture was shown, Mr. Norris launched into a talk on "Plastics Up-to-Date".

"Trends in the Development of Synthetic Rubbers" was the title of the second technical paper, which was delivered by Per K. Frolich, Director, Chemical Division, Esso Laboratories, Standard Oil Development Co., Linden, N. J. Dr. Frolich traced the development of the so-called synthetic rubbers from early experiments to the present.

Synthetic Rubber Types Discussed

Dr. Frolich then discussed the various types of synthetic rubbers available today, *i.e.*, the Bunas, the Perbunans, and neoprene, as well as what he termed a class of intermediate products, such as Koroseal, Thiokol and Vistanex. He said that although nature's rubber product probably is the outcome of a series of condensation reactions involving oxygenated intermediates, from a structural standpoint the rubber molecule can be considered a polymer of isoprene, or 2-methyl butadiene.

In connection with this view of the structure of natural rubber, Dr. Frolich said that the original methyl rubber manufactured in Germany was made from 2, 3-dimethyl butadiene simply because this diolefin could be made available more readily than isoprene at the time, and that the present choice of butadiene and chloroprene (*i.e.*, 2-chlorobutadiene) as raw materials for synthetic rubber production is largely a matter of availability and cost.

I. E. Lightbown, also associated with the Standard Oil Development Co., was the third and last speaker. Taking as his topic "Some Properties of Perbunan," Mr. Lightbown stated that in spite of chemical and structural differences, Perbunan is more like natural rubber than any of the other so-called synthetic rubbers commercially available. He then discussed the structure of Perbunan and methods of compounding it. (Mr. Lightbown's paper is reproduced elsewhere in this issue.)

The final feature of the program was the showing of the sound film "Inside the Flame," the movie which depicts the manufacture and application of carbon black, prepared by Godfrey L. Cabot, Inc., Boston, Mass.

OBITUARIES

Charles R. Boggs

Charles Reid Boggs, vice-president, general manager and a director of the Simplex Wire & Cable Co., Cambridge, Mass., died at his home in Waban, Mass., on April 1, at the age of 56, following an illness of several months. He was well known in both the rubber and cable industries.

Mr. Boggs was born in Nashville, Tenn., on November 22, 1883. He received his early education in the public schools and at Western High School in Washington, D. C., and was graduated from the Massachusetts Institute of Technology with a Bachelor of Science degree in 1905. Shortly after being graduated he joined Simplex Wire as chief chemist, first serving as an assistant in electro-chemistry at M.I.T. In 1918 he was made factory manager at Simplex Wire, was elected vice-president in 1930, became a director in 1934, and was appointed general manager in 1936.

Mr. Boggs was active in the field of research. He had a share in the discovery of vulcanization accelerators and held some of the original patents in the United States, a few of which played an important part in the Grasselli vs. National Aniline suit. He was also the discoverer of the vulcanizing effect of selenium and held patents on the use of this material as well as on the use of deproteinized rubber in cables to resist water absorption. He was also an active contributor to the technical literature, one of his articles covering a proposed method of determining rubber by means of its tetrabromide and another advancing a new theory of vulcanization. In recent years most of his work was concerned with the development of deproteinized rubber.

A great believer in industrial cooperation, Mr. Boggs was one of the organizers of the Rubber Division of the American Chemical Society, which was originally termed the India Rubber Chemistry Section. This was in 1909. He later was one of the sponsors of the idea of forming local rubber groups throughout the country and in 1927 was instrumental in the organization of the present Boston Rubber Group. He served as chairman of the parent division in 1924-25 and later as chairman of the Boston group. He was also a member of the committee for the celebration of the centennial of the discovery of vulcanization in connection with the meeting of the A.C.S. held in Boston last September.

Mr. Boggs was an active member of several other organizations, including the American Institute of Chemical Engineers, the American Institute of Electrical Engineers, the American Society for Testing Materials, and the American Society for the Advancement of Science. He was also a Fellow of the Institution of the Rubber Industry of England.

Funeral services were held in Union Church, Newton, Mass., on April 3. A widow, son and daughter survive.

William E. Crofut

William E. Crofut, founder and president of the Forest City Rubber Co., Cleveland, and one-time vice-president and director of the Ohio Rubber Co., Willoughby, Ohio, died at his home, 2500 Guilford Avenue, Cleveland Heights, on March 8, at the age of 65.

Born in Syracuse, Mr. Crofut was educated at Syracuse University. In 1900 he joined Ohio Rubber as a vice-president and director, and served with that company until 1905 when he founded the Forest City Rubber Company which he headed until his death.

Mr. Crofut was one of Cleveland's civic leaders. He was a former director of the Wholesale Merchant's Board of the Chamber of Commerce and the Cleveland Credit Men's Association. He was also a member of the St. Luke's Hospital Association and a director of the Y.M.C.A. During the World War he served as a non-commissioned officer on the war council of the American Red Cross.

Funeral services were held at the Crofut residence on March 11. Burial was in Lake View Cemetery. A widow and two children survive.

A. Whiton Vennema

A. Whiton Vennema, mechanical superintendent, Manhattan Rubber Manufacturing Division of Raybestos-Manhattan, Inc., Passaic, N. J., died at his home, 265 Gardner Road, Ridgewood, N. J., on March 23, at the age of 53, after a brief illness. He was associated with Manhattan Rubber for 31 years.

Mr. Vennema joined Manhattan Rubber shortly after being graduated from the Stevens Institute of Technology in 1909 with the degree of mechanical engineer. He occupied various positions with the company and was appointed mechanical engineer in charge of maintenance ten years ago. He was an active member of the American Society of Mechanical Engineers from 1916 to 1924. He was also a member of Beta Theta Pi and of the Kenilworth Society of Passaic. During the World War he served as a lieutenant in the Chemical Warfare Service of the Army.

Funeral services were held at the residence on March 25, with interment in Cedar Lawn Cemetery, Paterson, N. J. A widow and two sons survive.

Joseph H. Dunlap

Joseph H. Dunlap, temporarily serving as factory technical representative of the Goodyear Tire & Rubber Company in India, died suddenly last month at Sahaganj, near Calcutta. He was to have been relieved of his duties within a few days of his death. Mr. Dunlap had been with Goodyear, with the exception of a few years, since 1911.

Mr. Dunlap was born in Washington, Penna., and was graduated from Washington & Jefferson in 1907 and from M.I.T. in 1911. Shortly after being graduated from M.I.T. he joined Goodyear and was active in the construction of several of the company's plants. He leaves a widow and a son.

A. D. Usow

A. D. Usow, founder and president and treasurer of the Usow Rubber and Manufacturing Co., Oostburg, Wisconsin, and of the Badger Raincoat Co., Port Washington, Wisconsin, died in Chicago on March 26 following an illness of several months. Mr. Usow was a Mason, a member of the Rotary Club of Port Washington, and a member of the Milwaukee Athletic and the Woodmont Country clubs. He leaves a widow, a son and a daughter.

Charles Probasco

Charles Probasco, industrial engineer and one-time assistant to the president of the Ohio Rubber Company, died at his home, 31316 Lake Shore Boulevard, Willowick, Ohio, on March 10, at the age of 61. At the time of his death Mr. Probasco was employed as an examiner in the Cleveland office of the Reconstruction Finance Corporation. Funeral services were held on March 11. Interment was in Lebanon, Ohio. He leaves a widow and two daughters.

William J. Gallagher

William John Gallagher, former director of agriculture for Malaya and later managing director of the U. S. Rubber Company's plantations in Sumatra and Malaya, died in London, England, on March 28, at the age of 61. Mr. Gallagher took part in the creation of the present international rubber regulation agreement.

Augusta O. Matsner

Mrs. Augusta O. Matsner, said to be the first woman crude rubber importer in New York City, died on March 27 at her home in Minneapolis after a short illness. She is survived by a daughter, Mrs. Sidonie Matsner Gruenberg, executive director of the Child Study Association of America.

As this issue was going to press word was received of the death of Dr. Dudley Roberts, president of Rubatex Products, Inc., of New York City. An obituary will appear next month.

CANADIAN NEWS

W. Hugh Flynn, associated with the accounting and sales divisions of the Dunlop Tire & Rubber Goods Co., Ltd., Toronto, has been appointed controller of that company.

A. E. Wolter, manager of the Independent Rubber Co., Ltd., Moncton, N. B., for the past seven years, has been transferred to the main office of the company at Montreal.

Cambridge Rubber Co., Ltd., has moved its Montreal offices and sales rooms to the Castle Building, 1410 Stanley St. J. G. Prout is sales manager.

R. C. Berkinshaw, general manager and treasurer of the Goodyear Tire & Rubber Co. of Canada, New Toronto, was recently elected to the directorate of the Crown Trust Co., Ltd., of Montreal. He was also recently elected president of the Toronto Board of Trade.

"The rubber industry in Canada is on the eve of a tremendous expansion," said W. H. Funston, president, Firestone Tire & Rubber Co. of Canada, Hamilton, Ontario, in a recent interview in Vancouver, B. C. "War demands for increased farm output will mean a considerable increase in the use of tires on the farm," he predicted.

Stedfast Rubber Co. of Canada, Granby, Quebec, has started construction of a new addition to its plant. The present factory floor space is 28,000 feet and the new building will add another 50,000 square feet of manufacturing area. Additional land for further expansion is available to the company on its factory site.

Woodstock Rubber Co., Ltd., Woodstock, Ontario, has decided to retire from the manufacturing field. All of the company's products in the future will be made for it by some other leading rubber manufacturer under private brand. It is understood that the company will maintain its own stylist and chemist to assure the same quality products sold by the company in the past.

According to A. G. Partridge, president of the Goodyear Tire & Rubber Co. of Canada, New Toronto, Ontario, the increase in tire prices to the automobile manufacturers recently announced by the parent American company does not apply in the Canadian market.

Charles S. Watson, for many years advertising manager of Canadian Goodyear, is now associated with Canada Bud Breweries, Ltd., Toronto, in an executive sales position.

Total sales and profits of Canadian Goodyear for the first quarter of the year are well over the corresponding period of last year, although export sales are down due to war conditions affecting foreign trade, according to A. G. Partridge, president. Sales of new motor vehicles in Canada, he said, both passenger cars and trucks, are showing a considerable increase over 1939, with a corresponding increase in the company's tire sales.

General Tire & Rubber Co. of Canada, Ltd., Toronto, Ontario, will have the largest newspaper campaign this year since it entered the Canadian market some six years ago, according to V. P. Reid, vice-president and general manager. The company had a very successful year in 1939. The new campaign calls for the use of both daily and weekly newspapers, covering 71 regional markets in the Dominion.

Sues to Dissolve Waterman

Elisha H. Waterman, grandson of the founder of the L. E. Waterman Company, fountain pen manufacturers, filed suit in the Supreme Court on April 2 charging a brother, an uncle, a cousin and other officials of the company with mismanaging and wasting its assets. He asked that the company be ordered dissolved and that the defendants be made to account for their actions. Mr. Waterman was executive vice-president of the Waterman concern for many years, but resigned from that post on February 14. At this writing (April 9) no answer had been filed to the suit.

May Seek Detroit Plant

According to reports from Akron, the Goodyear Tire & Rubber Company is eyeing Detroit as a possible location for a new factory for the manufacture of Airfoam, its latex foam sponge rubber. Detroit's advantages with respect to incoming shipments, plus the proximity to the automobile plants, are said to figure heavily in the possibility.

To Manufacture Rubber Veneer

According to reports from Hungary, a new company has been formed in Budapest to utilize a patent for the chemical treatment of fine furniture. Instead of veneering furniture with wood, a special rubber layer is laid over the surface. Early experiments are said to have proved the method practical.

CONTEST RULES ARE ISSUED BY NEW YORK RUBBER GROUP

The rules for submission of papers in the Technical Paper Contest sponsored by the New York Group, Rubber Division, A.C.S., have been issued by the Contest Committee, as follows:

(1) Contestants must be under 35 years of age and be paid-up members of the New York Group.

(2) Subject Matter: Papers should be of a technical nature relating to rubber or the so-called synthetic rubbers—properties, compounding materials, practice, processing methods, technical equipment, or some such phase of rubber technology. Papers may be the result of original work, development results or interpretive results of rubber literature.

(3) All papers must be submitted in *triplicate,* with the authors name *omitted.* Attach name and address of the author separately to each copy. Each paper will be coded or otherwise numbered so that the judges cannot identify the author. All entries must be typewritten on 8½ x 11 inch paper, double spaced. In general, papers should conform in style to the form of papers published in "Industrial & Engineering Chemistry": *i.e.,* they shall contain the following essentials: Abstract; Aim or Purpose; Body of Paper; Summary; Bibliography. This form is suggested only, and need not be followed exactly to qualify.

(4) Papers submitted will become the property of the New York Group, and their publication in the trade press will be at the discretion and by selection of the Contest Committee.

(5) Prizes: The Committee will select the three papers deemed best in its judgment, and prizes totalling at least $100 will be distributed to the winners in the order of their value as decided by the Committee.

(6) All entries must be received by Thursday, September 5, 1940. They should be sent to Charles R. Haynes, Chairman, c/o Binney & Smith Co., 41 East 42nd Street, New York City.

Fisk Rubber Corp. Dissolved

Stockholders of the Fisk Rubber Corporation, the assets of which were sold to the United States Rubber Company last December, voted to dissolve the corporation at a special meeting held in Wilmington, Delaware, on March 12. Officers of the company were instructed to turn over the corporation's remaining assets to U. S. Rubber. The action was the final step in terminating the affairs of Fisk Rubber and removing the corporation name from the stock list. It was later announced that a distribution of one-quarter share of U. S. Rubber common stock and $6.00 in cash will be made for each share of Fisk common stock upon surrender of the common stock certificate to the Central Hanover Bank and Trust Company in New York City.

CALCINED MAGNESIA

FOR NEOPRENE

3 TYPES

to meet the diverse requirements of the trade—in quality and cost.

LIGHT	The highest type, for the most exacting compounds. Fine particle size. Low moisture and carbonate content.
MEDIUM	**For requirements less exacting, and where lower costs are imperative. Fine particle size. Low moisture content.**
HEAVY	**Meets the need of lowest cost, where high type compounding is not essential.**

Samples, prices and further information will be sent promptly on request. Address

WHITTAKER, CLARK & DANIELS, INC.

260 West Broadway New York City

CHICAGO
Harry Holland & Sons

AKRON
Frank Zeck & Co.

Leaders in Holland Cloth

THEY QUALIFY ON ALL THREE COUNTS

•

FINEST FINISH OR GLAZE

•

NO FLAKING

•

FREE FROM PINHOLES

EAGLE BRAND
The finest Holland Cloth for **hot cures** in rubber mills. Retains its whiteness of color under heat and calendering.

CARDINAL BRAND
Recommended for **cold cures** when low temperature is used in the processing or in the vulcanizing by the consuming trade.

Standard Widths: 20", 30" and 40".
Length of Rolls: 100 yds. and 250 yds.

Send for prices and a copy of our new catalog containing samples on these superior Holland Cloths which are used by leading rubber manufacturers.

ARKWRIGHT FINISHING COMPANY

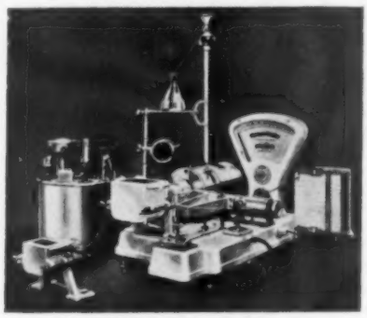
PROVIDENCE, RHODE ISLAND

Sales Office: Rockefeller Bldg., Cleveland, Ohio
Pacific Coast Agents: L. H. Butcher Co.—San Francisco and Los Angeles

NEW EQUIPMENT

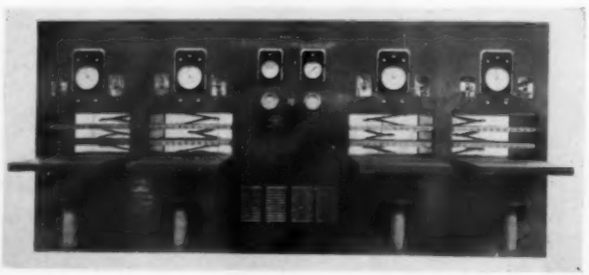
Plastograph for Measuring Consistencies

A recording plastometer, based on the dynanometer principle, which practically "weighs" the plasticity of different materials, has been introduced by the Brabender Corporation, Rochelle Park, N. J. Called the "Plastograph," the new instrument measures consistency over a wide range of materials—from fairly viscous, syrupy substances to unvulcanized rubber. The Plastograph has three different sensitivity settings and can measure and record within each desired range with three times and five times increased sensitivity by the simple expedient of zero-suppression. It records automatically, by means of a curve, changes of the structure of plastic materials due to mechanical effort, changes of the mixture, temperature, water absorption, swelling, addition of ingredients, etc. It can be supplied with various types of mixers or agitators, all water-jacketed for efficient temperature control. The Plastograph is said to find application in both laboratory use and in plant control.



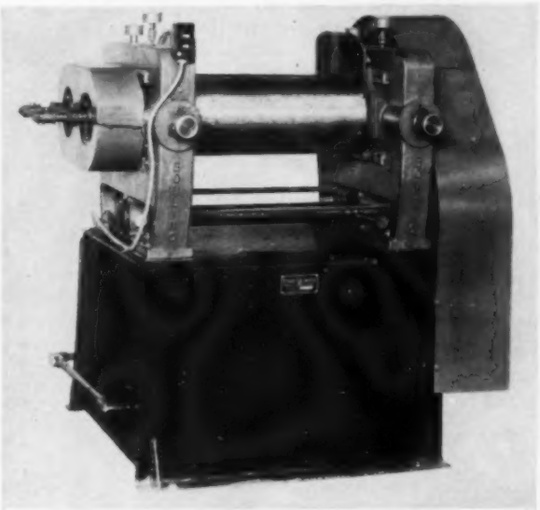
Four-Press Rubber Molding Unit

A complete unit, made up of four presses, each with 24-inch diameter ram at 2,000 pounds working pressure, giving 450 tons per press, has been developed by the French Oil Mill Machinery Co., Piqua, Ohio. Each press has three openings and 36 x 36-inch platens. In the center section, built into the unit, are pumps, accumulators and control valves. The molding shelf of each press is raised and lowered by an electrically-operated elevator, with push-button control. All instruments are flush-mounted and controls include automatic temperature control, with a recording instrument for each press, automatic pressure regulation, automatic cycle control, and automatic bumping.



Stewart Bolling Using Meehanite Rolls

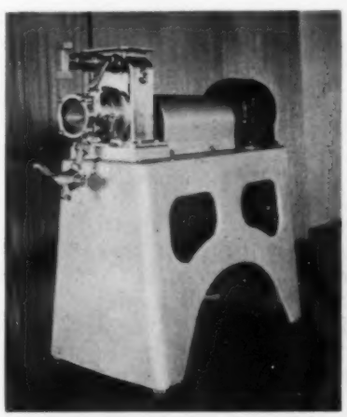
Stewart Bolling & Co., Cleveland, Ohio, is now using Meehanite rolls on various rubber mills and other units up to 10 x 24-inch sizes. Meehanite rolls, which are said to offer superior strength with very low



deflection and high hardness, are based on a process developed by the Meehanite Research Institute of Pittsburgh, Penna. The rolls are not chilled but are heat-treated for hardness by quenching and drawing, much the same as high carbon steels are heat-treated for hardness. The rolls require only about one-half as much crowning as chilled rolls due to greater stiffness of the metal. The rolls are rough machined before heat treatment. The latter consists of heating to 1600° F., oil quenching, and drawing at a temperature of 350° F., providing an average hardness of about 78 sclerescope.

Promulsor Dispersion Machine

A new machine for dispersion, disintegration and emulsification of liquids and solids in liquids, which finds application in the rubber industry in connection



with latex compounds, is being featured by the Promulsor Corporation, 1270 Sixth Avenue, New York City. An outstanding feature of the unit is the rela-

Stauffer Chemicals

TIRE BRAND
Commercial Rubbermakers' Sulphur, 99½% Pure

TUBE BRAND
Refined Rubbermakers' Sulphur, 100% Pure

CRYSTEX (INSOLUBLE) SULPHUR

SULPHUR CHLORIDE

CAUSTIC SODA

CARBON BISULPHIDE

CARBON TETRACHLORIDE

STAUFFER CHEMICAL CO
420 LEXINGTON AVE., NEW YORK, N. Y.
230 NO. MICH. AVE., CHICAGO, ILL.
624 CALIFORNIA ST., SAN FRANCISCO, CAL.
555 SO. FLOWER ST., LOS ANGELES, CAL.
424 OHIO BUILDING, AKRON, OHIO
FREEPORT, TEXAS APOPKA, FLORIDA

Scrap Rubber

CRUDE RUBBER • HARD RUBBER DUST

A. Schulman INC.

● AKRON, OHIO DARROW ROAD
● E. ST. LOUIS, ILL. 14th AND CONVERSE STS.
● BOSTON, MASS. 736 STATLER BUILDING

WAREHOUSES • AKRON, OHIO • E. ST. LOUIS, ILL.

COMING TO
NEW YORK?
STOP AT "A GREAT HOTEL"
1 block from Penn Station and Empire State Building
B. & O. buses stop at our door
LARGE, BEAUTIFUL ROOMS WITH PRIVATE BATHS
Single from $3 daily • Double from $4.50 daily
HOTEL McALPIN
BROADWAY at 34th ST., NEW YORK
Under KNOTT Management John J. Woelfle, Manager

tively large clearances between moving parts. The shearing action of the Promulsor machine is accomplished by a combination of hydraulic pressure developed by the impingement of the processed materials against the baffles, as well as the material when thrown back on itself from the baffles. Other features include elimination of air, which tends to produce more stable emulsions, low cost operation, simple and sanitary construction, and jacketing for cooling or heating.

Chiksan High Temperature Swing Joint

Designed for operation at working pressures up to 500 pounds at temperatures up to 700° F., a new high temperature swing joint has been developed by the Chiksan Tool Co., Brea, California. Special care has been taken in the new joint to provide for unobstructed flow through all bends. Increased diameters are provided at the elbows to assure maximum flow with minimum pressure drop. There are no packing glands or stuffing boxes to repack in the joint, and no nuts

and bolts to keep tight. To provide a smooth, long-wearing surface, the packing chamber, in which the packing is held in place by the tension of a special alloy wire spring, is machined to close tolerances and then chromium-plated and polished. The new Chiksan swing joint is made in six different styles for full 360° rotation in one, two and three planes. The joint illustrated is intended for applications where rotation in two planes is required.

Vacuum-Type Applicator for Pliofilm

Anticipating stretch-wrap application of Pliofilm to powdered, granular and even liquid substances, the Goodyear Tire & Rubber Co., Akron, Ohio, has developed a vacuum-type applicator which will work equally well with solid articles. Principle of the new device in operation is as follows: A sheet of Pliofilm is held in place over the aperture of a metal chamber of the desired size, open at the top. An arrangement of outlets connected with a pipe circuit permits exhaustion of air from the metal chamber. Pliofilm sheet is heated and exhaustion of air from the chamber causes the sheet to expand from the pull of the partial vacuum and fit against the contour of the chamber's walls. Material to be packaged then is poured into the pre-shaped package, which is heat sealed by twisting the opening, prior to release of the edges of the sheet for removal from the machine.

REVIEWS

BOOKS

1939 Book of A.S.T.M. Standards. (In Three Parts). Part I: Metals, 1,335 pages. Part II: Non-Metallic Materials—Constructional, 1,250 pages. Part III: Non-Metallic Materials—General, 1,205 pages. Published by the American Society for Testing Materials, 260 South Broad St., Philadelphia, Penna. Prices (to non-members): Any one part, $8.00; any two parts, $15.00; all three parts, $22.00. Each part, 6 x 9 in.

Important changes are incorporated in this latest A.S.T.M. publication. For the first time it contains *all* of the Society's specifications, whether standard or tentative. Formerly, the tentative specifications were issued in an annual volume, but the convenience of having these and the formally adopted standards in one volume led to the present combination. Another change is that the book is in three parts, instead of only two parts as before. Each part, the contents of which is indicated by the respective titles, contains a complete subject index. Three tables of contents help make the book of maximum utility. The first lists items under the general materials covered, the second gives a complete list of all the items in the part by numeric sequence, while the third covers by subject the tentative standards which appear in the back portion of each part.

In all, there are 866 separate standard and tentative specifications, methods of test, definitions, etc., in the three parts, with 28 duplications. Part I has 298 items, Part II has 351, and Part III has 245. Thirty specifications, tests, definitions, etc., on rubber products appear in Part III. These cover general methods, hose and belting, gloves, matting and tape, wire and cable, cement, and sponge and hard rubber products. Practically all of the specifications and tests have been reset in a new double-column format, the new style resulting in easier and better readability. The method of issuing the 1939 Book of Standards also provides that a supplement to each of the three parts be issued in 1940 and 1941. Purchasers of the book may subscribe for these supplements at the same time.

•

Rubber Latex. By Henry P. and W. H. Stevens. Chemical Publishing Co., Inc., 148 Lafayette St., New York City. 5½ x 8½ in. 224 pp. $2.00. (American Edition).

Although the title page of this book bears the inscription "First American Edition—1940," the book is actually a photo-offset reproduction of the fourth edition of the book by the same name published in 1936 by the Rubber Growers Association, Inc., in England. The latter book was reviewed in the June, 1936, issue of RUBBER AGE. It will be recalled that the book consists of 8 chapters, a section giving short abstracts of British patents on latex, a brief bibliography, and subject, patent and patentee indexes. It discusses the source, properties, concentration, compounding, vulcanization, marketing and use of latex.

The first edition of "Rubber Latex" was issued in 1928 by the Rubber Growers Association. In keeping with the expressed policy of the Association it was supplied to all those desiring copies without cost. The purpose of the book was to arouse interest in the use of latex, not only in the rubber industry itself, but in the textile, paper, leather and other industries. This policy of free distribution was continued with the second edition, published in 1933, the third, in the same year, and the fourth in 1936. Each edition was revised and brought up-to-date.

The American edition of the book sells for $2.00 per copy. Presumably, free copies will no longer be distributed by the

NEVILLE

RESINS

for Rubber Compounding

Neville Paracoumarone-indene Resins are neutral, chemically resistant and water-proof, will not deteriorate on aging, and provide efficient, economical softening action and tack-production in rubber compounds, especially light-colored goods. Also suitable for use with Neoprene, Pliolite, Thiokol and Chlorinated Rubber.

Ask about Neville Resins for rubber heels, soles, tires, tubes, cements, etc.

R-4

Send for booklet "NEVILLE RESINS"

THE NEVILLE COMPANY

PITTSBURGH • PA.

Economic Characteristics of Rubber Tire Production

By L. E. Carlsmith

The book records the results of an investigation of the more important economic characteristics of the producing end of the tire industry, character of their trends, changes in relationships, etc. Primarily, the results are given mathematically and statistically with 37 charts and 48 tables used to illustrate the economic features of the industry.

230 Pages—Cloth Binding—6¼ x 9¼ in.
Complete Bibliography—Index

$4.00 *Postpaid*

THE RUBBER AGE

250 West 57th Street, New York, N. Y.

MONTEN WAX

127 rubber concerns, both here and abroad, are NOW USING OUR NEW MONTEN WAX in their process.

ARE YOU?

An American Synthetic Wax, Low in Cost and unaffected by EUROPEAN CONDITIONS

THE BEACON COMPANY, 87 Bickford St., Boston, Mass.

MECHANICAL MOLDED RUBBER GOODS

Sponge Rubber: Sheeted—Die Cut—Molded

We Solicit Your Inquiries

THE BARR RUBBER PRODUCTS COMPANY

SANDUSKY, OHIO

COLORS for RUBBER

Red Iron Oxides

Green Chromium Oxides

Green Chromium Hydroxides

•

Reinforcing Fillers and Inerts

C. K. WILLIAMS & CO.

EASTON, PA.

Let us estimate on your

CUTTING DIES

• Years of experience making dies of all kinds for rubber manufacturers enable us to offer you correctly designed dies of tempered steel which retain their cutting edges....*Send blue print for quotation.*

BROCKTON CUTTING DIE & MACHINE CO. INC.
CUTTING AND PERFORATING DIES

AVON, MASS.

RMP ANTIMONY

• ATTRACTIVE

• NON-DETERIORATING

for RED RUBBER

RARE METAL PRODUCTS CO.
BELLEVILLE, N. J.

REVIEWS (CONT'D)

Rubber Growers Association, or rather by the British Rubber Publicity Association, a branch of the International Rubber Regulation Committee, which has taken over all propaganda work from the R.G.A. This presumption is based on the fact that the American edition, according to a printed statement in the book, is "reproduced by permission of the British Rubber Publicity Association."

•

The Tools of the Chemist. By Ernest Child. Published by the Reinhold Publishing Corp., 330 West 42nd St., New York City. 5¾ x 8½ in. 220 pp. $3.50.

This is the first comprehensive story of the part played by laboratory apparatus development in the history of chemical education in America. The author, long associated with manufacturers and dealers in chemical equipment in America and abroad, including ten years of service with the house of Eimer and Amend in New York City, concentrated his research on the events and the individuals whose work played a significant part in the creation and development of chemical laboratories and apparatus in this country, rather than on the evaluation of the scientific achievements of the many who have done so much to stimulate interest in chemistry and the advancement of science. The result is an interesting, well-written tale, the telling of which has long been overdue.

The book is divided into three parts: People and Events in American Chemistry; Ancestry and Development of American Chemical Laboratory Apparatus; and Distributors of Laboratory Apparatus. In a brief chapter on Rubber Ware, the history of laboratory tubing and molded rubber stopples is traced since the early experiments of Hancock about 1823. The book has a complete subject index.

•

Manual de la Industria de la Goma. By Luis Pascual Mejias Lopez. Published by *La Goma,* Calle de Moncada 4, Barcelona, Spain. 6½ x 9½ in. 362 pp. 50 pesetas. (In Spanish only).

This manual of the rubber industry is a condensed version in Spanish of the "Encyclopedie du Caoutchouc et des Industries qui s'y Rattachent," the French manual, published in 1929 by the *Revue Generale du Caoutchouc,* the French rubber journal. Whereas the French manual consisted of various chapters devoted to miscellaneous subjects pertaining to rubber and the manufacture of rubber products, each prepared by a leading technologist familiar with the particular topic, this Spanish manual was prepared by one author only. The Spanish manual, which like the French one discusses the source, collection and application of rubber in its many divers forms, was originally published some time late in 1936, and in fact carries a date-line of that year, but apparently the disturbances in Spain during the past few years has held up its receipt in this country until the present.

•

Varnish Making. Chemical Publishing Co., Inc., 148 Lafayette St., New York City. 5½ x 8½ in. 232 pp. $6.00.

This book is comprised mainly of papers read at the Second Conference of the Oil and Colour Chemists' Association, held in England in May of 1939, and the discussions which followed the presentation of each paper. In addition, there is included a special paper on the history of varnish making (written to make the volume complete) and another which was scheduled but not presented at the Conference. The purpose of the book was to correlate the physical and chemical changes taking place in varnish manufacture. Of special importance is a discussion of the new synthetic drying oils and a new approach to the study of the changes which occur during film formation. Formulas, diagrams, tables and photographs bear out the text. There are 17 papers included. Unfortunately, like so many other books prepared under British supervision, there is no subject index.

BOOKLETS, CATALOGS, Etc.

Solvent Recovery by the Columbia Activated Carbon System. Carbide and Carbon Chemicals Corp., 30 East 42nd St., New York City. 8¼ x 10¾ in. 32 pp.

The answer to most general questions regarding the Columbia Activated Carbon System of solvent recovery will be found in this well put-together booklet. It also clearly indicates where the system may be profitably employed. In addition, the booklet contains a section discussing applications of Columbia Activated Carbon other than its primary use for the recovery of volatile solvents, such as, for example, in the recovery of gasoline, removal of odors, and the removal of toxic vapors and gases from air. Rubber manufacturers should find this booklet of interest.

•

Revertex Concentrated Latex. Revertex Corporation of America, One Main St., Brooklyn, N. Y. 7½ x 10¾ in. 18 pp.

This booklet first discusses the types of Revertex available, sources of supply, and containers and storage, and then branches out into uses, compounding and processes for compounding the several types. In addition, a number of formulas, including one for the preparation of a flexible adhesive with good aging properties and another for making artificial leather, are given. The booklet is designed to give the reader the more important facts regarding the character, use and compounding of Revertex, and accordingly is printed in simple, easy-to-read style.

•

Kalvan. R. T. Vanderbilt Co., 230 Park Ave., New York City. 8⅝ x 11½ in. 16 pp.

The properties of Kalvan, the new ultra fine calcium carbonate introduced by the company, which is suitable for use in both light-colored and dark-colored rubber products, are detailed in this booklet. In addition, charts and tables indicate the tensile, hardness, tear resistance and flex-cracking resistance of various Kalvan compounds. The booklet shows how best results may be obtained with the new calcium carbonate.

•

Industrial Hazards of Static Electricity. Written and published by Harold Joe Davis, 3927 East Admiral Place, Tulsa, Oklahoma. 4 x 6¼ in. 10 pp. 25c.

Although no attempt is made in this pamphlet to present a complicated or extensive study of research work in the field of static electricity, the pamphlet does present some of the electrostatic hazards encountered in industry and gives suggestions for overcoming them. Such subjects as ionization, humidification, and grounding and bonding are discussed. The author is a safety engineer.

•

Why Anti-Friction Bearings? New Departure Division, General Motors Corp., Bristol, Conn. 5½ x 8½ in. 112 pp.

An impartial discussion of the factors to be considered in the selection of anti-friction bearings is contained in this booklet which is designed for use as a text book in engineering colleges and as an aid to young engineers and others who have an interest in all factors effecting the efficiency and performance of machines through the use of anti-friction bearings. The book is attractively printed and profusely illustrated.

•

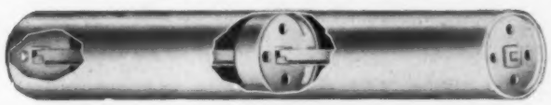
Gold Medal Letters—1940. Dartnell Corporation, 4660 Ravenswood Ave., Chicago, Ill. 8½ x 11½ in.

Copies of the twenty best business letters of the year, the authors of which received gold medals from Dartnell Service, are contained in this portfolio. The letters are concerned with various phases of business activity, from the making of sales to the collecting of money from unwilling debtors. The letters are judged on actual results.

AIR BAG BUFFING MACHINERY
STOCK SHELLS HOSE POLES
MANDRELS
NATIONAL SHERARDIZING & MACHINE CO.
868 Windsor St. Hartford, Conn.
Representatives: Akron San Francisco New York

12 Issues a Year
$2.00 Annual Subscription
THE RUBBER AGE

New and Better
GAMMETER'S
ALL STEEL ALL WELDED
CALENDER STOCK SHELL



4" - 5" - 6" - 8" - 10" - 12" diameters, any length.

Besides our well known Standard and Heavy Duty Constructions, we can supply light weight drums made up to suit your needs.

THE W. F. GAMMETER COMPANY
CADIZ, OHIO

MACRAE'S BLUE BOOK
America's Greatest Buying Guide
Lists manufacturers of everything used by the Rubber Industry
For complete information write
MacRAE'S BLUE BOOK CO.
18 E. Huron St., Chicago

The CARTER BELL MFG CO
CARTER BELL STANDARD SINCE 1903 RUBBER SUBSTITUTES
Springfield New Jersey

ADVERTISING PAGES REMOVED

MARKETS

RUBBER—COTTON AND FABRICS—CHEMICALS

NEW YORK, APRIL 9, 1940

Crude Rubber

PRICE of spot rubber on the Exchange dropped almost steadily from 18.84 on March 12 to 18.19 on March 27, with occasional upward trends setting in due to the release of favorable statistics. Factors responsible for the declining market included weakness in sterling, a drop in February consumption as compared with January, and the cessation of hostilities between Russia and Finland. Since the 1st of April, however, the price has showed increasing strength, with greater factory interest largely responsible for the trend. The price jumped from 18.50 yesterday (April 8) to 18.93 today (April 9), due to the widening of the European war to embrace the Scandinavian countries. With the spreading of hostilities abroad, and the addition of some of the Scandinavian countries as belligerents, dealers look for a tighter shipping situation, with corresponding increases in prices of spot and futures. Quotations in the outside market, Exchange, London and Singapore, follow:

As of April 9

Plantations—

Ribbed Smoked Sheets—

No. 1 Spot	—	@	.19
May-June	—	@	.18⅞
July-September	—	@	.18⅝
No. 2	—	@	.18⅞
No. 3	—	@	.18¾
No. 4	—	@	.18⅝
Thin Latex Crepe	—	@	.19⅛
Thick Latex Crepe	—	@	.19⅛
Brown Crepe, No. 1	—	@	.18⅝
Brown Crepe, No. 2	—	@	.18½
Amber Crepe, No. 2	—	@	.18½
Amber Crepe, No. 3	—	@	.18¼
Brown Crepe, Rolled	—	@	.15½

Latex—

Normal, per lb., carload lots	—	@	.23¾

Paras—

Up-River, fine	—	@	.17⅜
Acre Bolivian, fine	—	@	.17½

Balata

Surinam sheet	—	@	.40

LONDON MARKET

Standard Smoked Sheets—Buyers—April 9			
July-September	11⅛d	@	11¼d
October-December	11 1/16d	@	11¼d

SINGAPORE MARKET

Standard Smoked Sheets—Sellers—April 9			
April-June	—	@	10d
July-September	—	@	9⅜d

Reclaimed Rubber

There has been little activity in the reclaim market in the past few weeks. Consumption of reclaim in February amounted to 17,019 long tons, or 34.2% of the 49,832 long tons of crude rubber consumed. There has been no change in the price structure since our last report. Current quotations follow:

Shoe				
Unwashed	lb.	.06½	@	.06¾
Washed	lb.	.10	@	.10¼
Tube				
No. 2 (Compounded)	lb.	.09	@	.10
Red Tube	lb.	.09	@	.09¼
Tires				
Black (acid process)	lb.	.07	@	.07⅛
Black, selected tires	lb.	.06	@	.06¼
Dark Gray	lb.	.09¼	@	.10
White	lb.	.12½	@	.14
Truck, Heavy Gravity	lb.	.05½	@	.06
Truck, Light Gravity	lb.	.07	@	.07½
Miscellaneous				
Mechanical blends	lb.	.04½	@	.05

Scrap Rubber

(Delivered Akron Mills)

The scrap rubber market continues to be dull, with occasional flashes of increased activity. Prices have dropped slightly on several grades since our last report, including auto tire peeling and beadless tire stocks. Current quotations follow:

(Prices to Consumers)

Auto tire peelings	ton	20.50	@21.50
Mixed auto	ton	13.50	@14.00
Beadless tires	ton	16.50	@17.50
Clean solid truck tires	ton	30.00	@32.50
Boots and shoes	ton	21.00	@22.00
Arctics, untrimmed	ton	14.00	@15.00
Inner tubes, No. 1	lb.	.10	@ .11
Inner tubes, No. 2	lb.	.04¼	@ .04⅜
Inner tubes, Red	lb.	.04⅜	@ .04½

Cotton

Cotton prices have swung in a narrow 28 point range since our last report, high for the period being 10.93 and low 10.65. Every unfavorable factor affecting the market was shortly offset by some favorable angle, so that although quotations were erratic they swung in the narrow range mentioned. Trading was fairly active during the period, export shipments improved, and there was considerable speculative buying on better stocks. At only one point did the price break sharply, from 10.79 on March 25 to 10.65 the following day, a 14 point drop. This was attributed to excessive liquidation occasioned by renewed peace talk in England and sudden weakness in sterling exchange. The price moved into higher channels shortly thereafter. Today's price of 10.93, high for the period, was the result of the widening theatre of war in Europe which brought new buying power into the world's cotton markets. Quotations for middling uplands on the Exchange follow:

	Mar. 11*	April 9*		
	Close	High	Low	Close
July	10.50	10.65	10.63	10.63
October	9.89	9.99	9.94	9.98
December	....	9.85	9.80	9.84

* New Contract.

Tire Fabrics

(Prices Net at the Mill)

Peeler, carded, 23/5/3	lb.	.31¼	@ .31½
Peeler, carded, 23/4/3	lb.	.32¼	@ .32½
Peeler, carded, 15/3/3	lb.	.29¼	@ .29½
Peeler, carded, 15/4/2	lb.	.29¼	@ .29½
Peeler, carded, 13/3/3	lb.	.28¼	@ .28½
CHAFERS			
Carded, American, 1 1/16"	lb.	.31¼	@ .31¾
Carded, American, 1"	lb.	.22	@ .27½

Sheetings

48x40	36 in.	5.50	lb.	—	@ .04
40x40	36 in.	6.15	lb.	—	@ .03½
40x36	36 in.	6.50	lb.	—	@ .03⅜
48x48	40 in.	2.50	lb.	—	@ .08⅜
48x48	40 in.	2.85	lb.	—	@ .07⅜
56x60	40 in.	3.60	lb.	—	@ .07
48x44	40 in.	3.75	lb.	—	@ .05⅝

Ducks

Enameling (single filling)	lb.	.25	@	.29
Belting and Hose	lb.	.26¼	@	—
Single filling, A grade	lb.	.11¼	@	.12¼
Double filling	lb.	.12¼	@	.13¼

Closing Rubber Prices on New York Commodity Exchange, Inc.

No. 1 Standard Contract of 10 Tons

FROM MARCH 12 TO APRIL 9

Date		Spot	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Sales
Mar.	12	18.84	18.68	18.66	18.65	18.56	18.47	18.43	18.37	18.33	18.26	18.20	18.20	18.20	——	218
	13	18.69	18.55	18.54	18.54	18.44	18.35	18.32	18.29	18.24	18.15	18.05	18.05	18.05	——	125
	14	18.56	18.41	18.37	18.33	18.26	18.19	18.15	18.10	18.04	17.96	17.90	17.90	17.90	——	92
	15	18.31	18.20	18.15	18.11	18.05	18.00	17.95	17.90	17.80	17.77	17.74	17.74	17.74	——	259
	16	18.31	18.20	18.14	18.08	18.03	17.98	17.94	17.90	17.80	17.77	17.75	17.75	17.75	——	82
	17															
	18	18.35	18.25	18.20	18.14	18.08	18.02	17.99	17.95	17.87	17.84	17.81	17.81	17.81	——	93
	19	18.43	18.35	18.34	18.33	18.22	18.12	18.06	18.00	17.96	17.92	17.89	17.85	17.85	——	110
	20	18.45	18.38	18.38	18.38	18.28	18.17	18.11	18.06	18.01	17.97	17.93	17.88	17.88	——	44
	21	18.50	18.41	18.41	18.41	18.28	18.15	18.08	18.00	17.96	17.91	17.86	17.81	17.81	——	58
	22															
	23	18.55	18.45	18.45	18.45	18.31	18.17	18.11	18.06	18.01	17.95	17.90	17.85	17.85	——	6
	24															
	25	18.50	18.40	18.40	18.40	18.29	18.17	18.08	18.00	17.96	17.93	17.90	17.85	17.85	——	65
	26	18.25	18.16	18.16	18.16	18.03	17.90	17.86	17.83	17.79	17.76	17.73	17.69	17.69	——	144
	27	18.19	——	18.12	18.12	17.96	17.85	17.77	17.70	17.65	17.60	17.65	17.51	17.51	——	190
	28	18.25	——	18.17	18.17	18.03	17.89	17.82	17.75	17.69	17.63	17.58	17.54	17.54	——	120
	29	18.19	——	18.11	18.11	17.93	17.76	17.71	17.65	17.60	17.55	17.50	17.46	17.46	——	155
	30	18.19	——	18.25	18.10	17.91	17.72	17.65	17.59	17.53	17.47	17.42	17.38	17.38	——	87
	31															
Apr.	1	18.32	——	18.35	18.24	17.92	17.80	17.75	17.70	17.63	17.56	17.50	17.46	17.46	17.46	149
	2	18.50	——	18.45	18.38	18.16	17.94	17.84	17.75	17.72	17.68	17.65	17.61	17.61	17.61	255
	3	18.44	——	18.42	18.32	18.09	17.86	17.78	17.70	17.65	17.60	17.55	17.51	17.51	17.51	182
	4	18.31	——	18.29	18.19	17.95	17.71	17.60	17.50	17.46	17.41	17.36	17.32	17.32	17.32	157
	5	18.39	——	18.36	18.26	18.03	17.80	17.73	17.57	17.51	17.45	17.40	17.37	17.35	17.33	97
	6	18.50	——	18.50	18.42	18.10	17.80	17.73	17.67	17.59	17.52	17.45	17.43	17.41	17.39	55
	7															
	8	18.50	——	18.50	18.40	18.11	17.82	17.73	17.65	17.59	17.52	17.45	17.43	17.41	17.39	99
	9	18.93	——	18.92	18.82	18.57	18.32	18.22	18.12	17.95	17.92	17.90	17.88	17.86	17.84	329

New York
April 11, 1940

Rubber CHEMICAL Markets

All Quotations F.O.B. Works Unless Noted

ACCELERATORS

Organic			
A-1 (Thiocarbanilid)	lb.	.24 @	.30
A-10	lb.	.31 @	.35
A-11	lb.	.52 @	.65
A-19	lb.	.52 @	.65
A-32	lb.	.70 @	.80
A-77	lb.	.42 @	.55
A-100	lb.	.42 @	.55
Aldehyde ammonia, crystals	lb.	.65 @	.70
Altax	lb.	.55 @	.65
Butyl Zimate	lb.	2.50 @	—
Captax	lb.	.50 @	.57
Crylene	lb.	.55 @	.65
Di-Ortho-Tolyguanidine	lb.	.44 @	.46
Diphenylguanidine	lb.	.35 @	.36
El-Sixty	lb.	.50 @	.65
Ethyl Zimate	lb.	2.50 @	—
Ethylidene aniline	lb.	.42 @	.43
Formaldehyde aniline	lb.	.37½ @	.42
Guantal	lb.	.40 @	.50
Hepteen	lb.	.35 @	.40
Hexamethylenetetramine	lb.	.33 @	—
Lead Oleate, No. 999	lb.	.14 @	—
Witco		.15 @	—
Lithex	lb.	.18 @	.20
Methylenedianiline	lb.	.36 @	.37
Monex	lb.	— @	2.35
Oxynone	lb.	.64 @	.80
Phenex	lb.	.50 @	.55
Pip-Pip	lb.	2.50 @	—
Pipsolene	lb.	1.55 @	1.85
R & H 40	lb.	.40 @	.41
R & H 50-D	lb.	.42 @	.43
R-2	lb.	1.40 @	1.80
R-2 Crystals	lb.	2.50 @	2.75
R-23	lb.	.40 @	—
RN-2	lb.	1.40 @	1.80
RN-2 Crystals	lb.	2.00 @	2.25
Rotax	lb.	.60 @	.65
Safex	lb.	1.20 @	1.30
SPDX	lb.	.70 @	.75
Super-Sulphur No. 1	lb.	.50 @	—
No. 2	lb.	.18 @	.25
Thiocarbanilid, drums	lb.	.24 @	.30
Thiurad	lb.	— @	2.35
Trimene	lb.	.55 @	.65
base	lb.	1.05 @	1.20
Triphenylguanidine	lb.	.45 @	—
Tuads	lb.	2.35 @	—
Ulto	lb.	1.50 @	1.75
Ureka	lb.	.60 @	.75
Ureka Blend B	lb.	.60 @	.75
Ureka C	lb.	.56 @	.65
Vulcanex	lb.	.42 @	.43
Vulcanol	lb.	.85 @	—
Zimate	lb.	2.35 @	—
Inorganic			
Litharge, domestic	lb.	.07 @	.07½
Magnesia, calcined, heavy	lb.	.04 @	—

COLORS

Blacks (See Compounding Materials)

Blues			
Prussian	lb.	.36 @	.37
Ultramarine	lb.	.15 @	—
Browns			
Mapico	lb.	.13 @	—
Umber, Turkey	lb.	.04 @	.04½
Greens			
Chrome	lb.	.21 @	—
Chromium Oxide, bbl.	lb.	.21 @	—
Guignet's Green	lb.	.70 @	—
Reds			
Antimony			
crimson, 15/17	lb.	.45 @	—
sulfur, free	lb.	.48 @	.60
Indian English	lb.	.09 @	.10
Domestic (Maroon)	lb.	.11 @	—
Red oxide, pure	lb.	.10 @	.12
Rub-Er-Red, f.o.b. Easton	lb.	.09¼ @	—
Whites			
Cryptone, No. 19	lb.	.05¼ @	.05½
Cryptone CB, No. 21	lb.	.05¼ @	.05½
Cryptone, ZS-230	lb.	.07½ @	.07¾
Cryptone, ZS-86	lb.	.07½ @	.07¾
Lithopone			
Albalith, black label—11	lb.	.03¾ @	.04
Azolith	lb.	.03¾ @	.04
Ray-bar	lb.	.05¼ @	.05¾
Ray-cal	lb.	.05¼ @	.05¾
Rayox	lb.	.13 @	.14
Titanox A	lb.	.13 @	.14
Titanox B	lb.	.05¼ @	.05¾
Titanox C	lb.	.05 @	.05½
Zinc Oxide—American Process			
American Azo:			
ZZZ (lead free)	lb.	.06¼ @	.06½
Anaconda, lead free	lb.	.06¼ @	.06½
Horsehead Lead Free Brand:			
Special—3	lb.	.06¼ @	.06½
XX Red—4	lb.	.06¼ @	.06½
XX Red—72	lb.	.06¼ @	.06½
XX Red—78	lb.	.06¼ @	.06½
XX Red—103	lb.	.06¼ @	.06½
Kadox, black label—15	lb.	.06½ @	.06¾
Blue label—16	lb.	.06½ @	.06¾
Red label—17	lb.	.06½ @	.06¾
St. Joe, black label	lb.	.06¼ @	.06½
green label	lb.	.06¼ @	.06½
red label	lb.	.06¼ @	.06½
U. S. P.—7, bbls.	lb.	.09½ @	.09¾
Zinc Oxide—French Process			
Florence White seal—7 bbls.	lb.	.08½ @	.08¾
Green seal—8	lb.	.08 @	.08¼
Red seal—9	lb.	.07½ @	.07¾
Yellows			
Cadmolith	lb.	.55 @	.65
Chrome	lb.	.14½ @	.15½
Mapico	lb.	.09½ @	—

BLACKS

(In bags, carload lots)

Aerfloted Arrow	lb.	.0265 @	—
Certified	lb.	.0265 @	—
Certified Spheron	lb.	.0265 @	—
Continental	lb.	.0265 @	—
Disperso	lb.	.0265 @	—
Excello	lb.	.0265 @	—
Fumonex	lb.	.03 @	—
Fumonex Beads	lb.	.03 @	—
Gastex	lb.	.03 @	—
Kosmobile	lb.	.0265 @	—
Kosmobile 66	lb.	.0265 @	—
Micronex (Amarillo)	lb.	.0265 @	—
Micronex Beads (Amarillo)	lb.	.0265 @	—
Pelletex	lb.	.03 @	—
P-33	lb.	.0475 @	—
Supreme	lb.	.0265 @	—
Thermax	lb.	.02 @	—
Wyex	lb.	.0265 @	—

COMPOUNDING MATERIALS

Aluminum Flake	ton.	21.85 @	24.50
Ammonia carbonate, lump	lb.	.10½ @	.12
Asbestine	ton	13.00 @	15.00
Barium carbonate (98-100%)	ton	— @	—
Barium Dust	lb.	.05 @	.06
Barytes	ton	23.65 @	31.15
Bentonite	lb.	.02 @	.03
Blanc fixe dry f.o.b. works	ton	60.00 @	65.00
Calcene	ton	37.50 @	45.00
Catalpo (fact.)	lb.	.02 @	—
Chalk, precipitated			
Suprex white, extra lt.	ton	45.40 @	60.00
heavy	ton	45.00 @	55.00
Clay, Kaolin, domestic	ton	9.50 @	—
Aerfloated, Suprex	ton	10.00 @	22.00
Crown (f.o.b. plant)	ton	10.00 @	—
Dixie	ton	10.00 @	24.50
McNamee	ton	10.00 @	22.50
Par	ton	10.00 @	22.50
Witco	ton	10.00 @	—
Cotton Flock (Dark)	lb.	.10½ @	.13
Glues, extra white	lb.	.28 @	.30
medium white	lb.	.14 @	19
Kalite No. 1	ton	24.00 @	50.00
Kalite No. 3	ton	34.00 @	60.00
"Lime Crest" Industrial Filler No. 100	lb.	— @	—
Magnesium carbonate	lb.	.07½ @	—
Mica	ton	35.00 @	44.00
Mineralite	ton	— @	30.00
Pyrax A	ton	6.00 @	20.00
Rottenstone (powdered)	lb.	.02½ @	.05
Soapstone, powdered	ton	16.00 @	22.00
Starch, powdered	cwt.	2.90 @	4.10
Talc, domestic	ton	25.00 @	45.00
Whiting, commercial	ton	17.00 @	18.00
Columbia Filler	ton	9.00 @	14.00
English Cliffstone	ton	33.00 @	43.00
Witco	ton	6.00 @	—
Wood Flour	ton	20.00 @	25.00
Zinc Carbonate	lb.	— @	—
Zinc Stearate	lb.	— @	—

MINERAL RUBBER

285°-300° Mineral Rubber	ton	21.00 @	42.00
Black Diamond	ton	25.00 @	—
Genasco, solid (factory)	ton	25.00 @	27.00
Hard Hydrocarbon	ton	21.00 @	42.00
Parmr, solid	ton	21.00 @	27.00
Pioneer, MR, solid	ton		
Pioneer-granulated	ton		

MISCELLANEOUS

Aromatics—Rodo #0	lb.	3.50 @	4.00
Rodo #10	lb.	4.50 @	5.00
Curodex 19	lb.	2.75 @	—
Curodex 188	lb.	3.50 @	—
Curodex 198	lb.	4.50 @	—
Para-Dor No. 5145	lb.	2.00 @	—
Aresklene No. 375 (dispersing, wetting and penetrating agent)	lb.	.35 @	.50
Darvan (dispersing agent)	lb.	.30 @	.47
Santomerse S (dispersing, wetting, penetrating and stabilizing agent)	lb.	.11 @	.25
Sunproof	lb.	.22 @	.27
Sponge Paste	lb.	— @	.18
Tackol (tackifier)	lb.	.085 @	.18
Tonox	lb.	.52 @	.61

SOFTENERS

Acids			
Acetic, 28%, bbls.	100 lb.	2.53 @	2.78
Nitric, 36 degrees	cwt.	5.00 @	6.00
Sulfuric, 66 degrees	ton	15.50 @	16.50
Acids, Fatty			
Laurex	lb.	.10¾ @	.13¼
SL #10	lb.	.12 @	.14
Stearex Beads	lb.	.08 @	.09
Stearic, double pressed	lb.	.12½ @	.13½
Stearite	lb.	.10½ @	—
Alkalies			
Caustic Soda, 76%	cwt.	2.70 @	3.55
Soda Ash, 58%, C.L.	cwt.	— @	2.35
Oils			
Cycline Oil	gal.	.14 @	.20
Degras, bbls.	lb.	.07¾ @	.08
Fluxrite	lb.	.05½ @	.06½
Palm Niger	lb.	.05½ @	.06¾
Para-Flux	gal.	.17 @	.18
Para Lube	lb.	— @	.05
Petrolatum, light	lb.	.03½ @	.03¾
Pigmentaroil, tank cars	gal.	.16 @	—
in drums	gal.	.22½ @	.23½
Pine, steam distilled	gal.	.64 @	.69
Rosin Oil, cmpd	gal.	.40 @	—
Rubberol, f.o.b. Chicago	lb.	.13½ @	.14
Rubtack	lb.	.08 @	.10
Seedine, c.l.	lb.	.07¼ @	—
Tackol	lb.	.08½ @	.18
Witco Palm Oil	lb.	.07 @	—
Witco Softener No. 20	gal.	.20 @	—
Woburn No. 8, c.l.	lb.	.66 @	—
Wobonite, c.l.	lb.	.05 @	—
Resins and Pitches			
Pitch, Burgundy	lb.	.05½ @	.06½
coal tar	ton	19.00 @	22.00
hardwood	ton	16.00 @	22.50
pine, 200 lb. gr. wt.	bbl.	6.00 @	6.50
Pigmentar, tank cars	gal.	.16 @	—
in drums	gal.	.22½ @	.23½
R. S. L. Resin	lb.	— @	—
Retort Pine Tar, drums	ton	20.00 @	26.00
Solvents			
Acetone, pure	lb.	— @	—
Alcohol, denatured, methanol, No. 1 bbls.	gal.	.33 @	.39
Benzene, 90%	gal.	.18 @	.23
Beta-Trichlorethane	gal.	— @	.20
Bondogen	lb.	.98 @	1.50
Carbon, bisulfide	lb.	.05¼ @	.08
Carbon tetrachloride	gal.	.73 @	1.065
Dichlorethylene	lb.	— @	—
Dipentene, cml., drums	gal	.41 @	.50
Ethylene dichloride	lb.	.06 @	.07
Plastogen	lb.	.07¼ @	.12
Reogen (drums)	lb.	.11½ @	.26
Rub-Sol (f.o.b. Okla.)	gal.	.09 @	—
Trichlorethylene	lb.	— @	.08½
Turpentine, spirits	gal.	.43 @	.47
dest. dist., drums	gal.	.33 @	.41
Waxes			
Beeswax, white	lb.	.39 @	.45
Carnauba, yellow	lb.	.46 @	.47½
Ceresin, white, domi	lb.	.08 @	.11
Montan, crude	lb.	.10¾ @	.11¾
Paraffin (c.l.—f.o.b. N. Y.)			
Yellow crude scale	lb.	.02¾ @	—
White crude scale 124/126	lb.	.02¾ @	.03
Refined, 122/127	lb.	.04½ @	—

ANTI-OXIDANTS

Agerite Alba	lb.	1.50 @	1.95
Exel	lb.	1.00 @	1.40
Gel	lb.	.57 @	.73
Hipar	lb.	.65 @	.92
Powder	lb.	.52 @	.64
Resin	lb.	.52 @	.64
Resin D	lb.	.52 @	.64
White	lb.	1.25 @	1.60
Albasan	lb.	.70 @	.75
Antox	lb.	— @	.56
B-L-E	lb.	.52 @	.61
Flectol B	lb.	.52 @	.65
Flectol H	lb.	.52 @	.65
Flectol White	lb.	.90 @	1.15
Neozone	lb.	.52 @	.63
Oxynone	lb.	.64 @	.80
Retardex	lb.	.35 @	.40
Santoflex B	lb.	.52 @	.65
Santovar A	lb.	1.15 @	1.40
S.C.R.	lb.	.33 @	.35
Stabilite	lb.	.52 @	.54
Stabilite Alba	lb.	.70 @	.75
VGB	lb.	.52 @	.61

MOLD LUBRICANTS

Aresklene	lb.	.35 @	.50
Cocoa Soapstock	lb.	.06 @	.08
Dipex	lb.	.06 @	.08
Lubrex	lb.	.25 @	.30
Mineralite	ton	— @	30.00
Mold Paste	lb.	.12 @	.18
Rubberol, f.o.b. Chicago	lb.	.13½ @	.14
Rusco, f.o.b. Nitro	lb.	.12 @	.30
Sericite, f.o.b. N. Y.	ton	65.00 @	—
Soap Tree Bark, cut, sifted	lb.	.06 @	.08

FACTICE OR RUBBER SUBSTITUTES

Amberex	lb.	.17 @	—
Black	lb.	.08 @	.12
White	lb.	.08½ @	.12
Brown	lb.	.08 @	.10½
Neophax	lb.	.09¼ @	—

VULCANIZING INGREDIENTS

Dispersed Sulfur No. 2	lb.	.07½ @	.15
Sulfur Chloride, yellow (drs.)	lb.	.04 @	—
Sulfur flour,			
Refined, 100% pure (bags)	cwt.	2.50 @	3.65
Commercial (bags)	cwt.	1.60 @	2.35
Telloy	lb.	1.75 @	—
Vandex	lb.	1.75 @	—

Crude Rubber
Latex and Guayule
Reclaimed Rubber
Tires and Tubes

STATISTICS OF THE INDUSTRY

Rim Production
Automobiles
Gasoline
Cotton Prices

U. S. Imports and Exports of Crude Rubber

YEARS	Gross Imports: Long Tons	Gross Imports: Total Declared Value	Gross Imports: Average Declared Value per pound Cents	Re-exports: Long Tons	Re-exports: Total Declared Value	Re-exports: Average Declared Value per pound Cents	Net Imports: Long Tons
1924	325,899	173,367,272	23.75	10,309	6,057,637	26.23	315,590
1925	393,370	426,167,504	48.36	14,827	19,847,753	59.76	378,543
1926	409,944	501,131,064	54.57	17,671	22,470,583	56.77	392,273
1927	424,733	338,688,492	35.60	27,775	24,735,488	39.76	396,958
1928	432,633	242,727,423	25.05	32,159	18,128,761	25.17	400,474
1929	560,082	239,177,811	19.06	36,485	16,868,718	20.64	523,597
1930	482,083	139,133,048	12.88	30,205	9,310,205	13.76	451,878
1931	497,176	72,922,845	6.55	25,595	4,255,572	7.42	471,581
1932	409,356	31,936,459	3.48	20,930	2,015,612	4.30	388,626
1933	407,817	44,034,064	4.82	20,537	2,601,352	5.65	387,280
1934	449,513	97,929,676	9.73	23,848	5,770,109	10.80	425,665
1935	453,134	115,299,448	11.36	11,389	3,084,331	12.09	441,745
1936	467,064	152,072,196	14.54	12,581	4,488,223	15.93	454,483
1937	574,600	237,307,041	18.44	7,902	3,385,433	19.02	566,698
1938	397,620	125,357,730	14.07	5,652	1,799,124	14.21	391,968
1939	469,803	167,558,245	15.92	13,125	5,832,618	19.84	456,678
1939:							
Jan.	35,235	12,313,006	15.59	468	165,663	15.79	34,787
Feb.	29,109	10,269,224	15.75	460	152,113	14.76	28,649
Mar.	43,490	15,058,279	15.46	439	171,279	17.43	43,051
Apr.	30,836	10,400,125	15.06	440	151,644	15.38	30,396
May	42,998	15,041,433	15.62	496	180,091	16.20	42,502
June	32,437	11,403,150	15.69	413	147,910	16.00	32,024
July	34,288	12,071,105	15.72	440	164,428	16.69	33,848
Aug.	35,794	12,702,958	15.84	267	89,741	15.01	35,527
Sept.	35,006	12,667,740	16.16	1,472	659,055	19.98	33,534
Oct.	42,784	15,211,621	15.87	5,886	2,881,172	21.85	36,898
Nov.	39,422	14,555,150	16.48	1,228	539,763	19.63	38,194
Dec.	68,384	25,861,354	16.88	1,116	529,759	21.20	67,268
1940:							
Jan.	68,962	26,314,500	17.03	955	447,673	20.92	68,007
Feb.	40,603	15,578,517	17.13	1,291	599,819	20.74	39,312

Note: "Gross Imports" do not include latex or guayule. To secure more accurate figures for "Net Imports" latex and guayule figures (shown below) should be added and the re-export figure deducted from the total. Annual figures for 1922, however, include both latex and guayule: guayule only is included in 1923. Annual figures for 1922-36 were revised in February, 1937.

United States Imports of Guayule. Balata. Jelutong, Liquid Latex

(All Quantities in Long Tons)

	Guayule: Tons	Guayule: Dollars	Balata: Tons	Balata: Dollars	Jelutong: Tons	Jelutong: Dollars	Liquid Latex (1): Tons	Liquid Latex (1): Dollars
1924	1,356	536,392	464	568,456	6,165	1,237,100	2,157	864,059
1925	3,781	1,803,448	517	574,750	6,749	1,642,531	3,272	3,537,510
1926	4,305	2,562,096	354	327,213	7,263	3,127,757	3,394	4,686,743
1927	5,018	2,674,957	582	477,246	7,785	2,448,657	1,495	1,170,650
1928	3,077	1,755,685	731	430,855	7,552	2,540,059	4,007	2,121,786
1929	1,275	545,175	728	566,964	8,204	2,458,126	3,729	1,788,391
1930	1,096	347,388	502	422,684	5,907	1,403,244	4,458	1,508,786
1931	....	.....	1,207	411,380	5,777	1,019,010	4,675	888,909
1932	....	.....	707	147,403	4,607	616,596	5,112	601,999
1933	....	.....	1,659	2,261,869	5,990	944,895	11,085	1,833,671
1934	398	75,349	1,054	438,209	4,987	943,752	13,107	3,643,221
1935	459	86,835	615	188,384	5,644	1,063,126	13,553	3,782,222
1936	1,229	286,552	535	199,368	6,163	1,296,364	19,852	6,659,899
1937	2,694	745,873	354	151,344	7,109	2,017,786	23,185	10,213,670
1938	2,485	623,819	509	181,140	9,132	2,944,504	11,878	4,147,318
1939	2,232	463,345	694	265,553	6,640	1,603,418	27,438	10,467,552
1939:								
Jan.	226	49,580	61	20,417	843	203,753	1,602	599,927
Feb.	212	46,576	15	4,426	510	129,726	1,717	657,565
Mar.	229	39,520	14	5,215	641	136,112	2,005	731,302
Apr.	180	24,584	59	18,170	281	72,024	1,018	360,739
May	102	22,347	56	16,359	645	161,745	2,786	1,067,682
June	91	19,879	119	33,876	597	122,087	1,836	694,863
July	150	32,626	39	18,813	663	141,540	2,934	1,064,927
Aug.	178	38,687	28	8,689	742	208,156	2,614	1,001,013
Sept.	133	30,091	36	19,682	479	100,285	2,525	965,615
Oct.	282	61,376	107	43,267	465	127,084	2,555	968,207
Nov.	214	46,558	96	37,858	289	74,358	3,071	1,227,788
Dec.	236	51,521	64	38,781	477	126,548	2,779	1,127,924
1940:								
Jan.	128	27,901	34	19,478	612	155,570	3,410	1,412,728
Feb.	314	70,251	55	26,420	461	134,878	2,171	947,524

(1) Weight given in pounds of dry rubber contained in latex.
Note: Annual figures for 1924-1936 revised on basis of information received on February 8, 1937.

U. S. Consumption of Crude Rubber

(Rubber Manufacturers' Association statistics raised to 100 per cent—All figures in long tons)

	Figures on Monthly Basis: 1933	1934	1935	1936	1937	1938	1939	1940
Jan.	22,645	39,190	46,636	48,631	50,879	31,265	46,234	54,978
Feb.	21,392	40,515	42,720	36,841	51,950	25,357	42,365	49,832
Mar.	17,843	47,003	42,153	42,813	54,129	32,389	50,165	.....
Apr.	25,928	44,853	44,247	52,031	51,859	29,730	44,166	.....
May	44,074	42,918	41,101	50,612	51,795	30,753	44,377	.....
June	50,743	40,147	36,156	52,772	51,860	32,540	47,259	.....
July	49,614	32,553	35,917	48,250	43,703	34,219	43,880	.....
Aug.	44,428	33,216	38,775	46,777	41,506	40,552	50,481	.....
Sept.	35,281	30,258	37,086	46,449	43,945	40,183	50,150	.....
Oct.	31,543	31,253	41,969	49,637	38,754	42,850	55,764	.....
Nov.	28,831	34,748	42,310	50,433	34,025	49,050	54,322	.....
Dec.	28,757	36,569	42,474	49,754	29,195	48,143	48,428	.....
Tot.	401,079	453,223	491,544	575,000	543,600	437,031	577,591	.....

* Revised.
Note: All figures are now based on Department of Commerce survey figures.

Reclaimed Rubber in the United States

(All Quantities in Long Tons)

Year	Production	Consumption: Tons	Consumption: % to Crude	Stocks[a]	Year	Production	Consumption: Tons	Consumption: % to Crude	Stocks[a]
1930	157,967	153,497	40.8	22,000	1935	122,948	113,078	23.0	25,069
1931	133,351	124,126	33.9	19,257	1936	150,571	141,486	24.6	19,000
1932	75,608	77,504	23.4	16,354	1937	185,033	162,000	29.8	28,800
1933	99,560	81,602	19.9	20,746	1938	122,403	120,800	27.6	23,000
1934	110,010	100,597	22.2	23,079	1939	198,815	184,942	32.0	25,427

	Figures on Monthly Basis: Production	Consumption: Tons	Consumption: % to Crude	Stocks[a]		Production	Consumption: Tons	Consumption: % to Crude	Stocks[a]
1939:*									
Jan.	14,826	13,743	29.7	23,334	July	12,588	13,542	30.9	21,339
Feb.	14,102	13,347	31.5	23,461	Aug.	17,595	16,846	33.4	21,024
Mar.	15,647	16,197	32.3	22,155	Sept.	17,990	16,953	33.8	21,185
Apr.	14,527	13,391	30.3	22,628	Oct.	20,896	18,955	34.0	21,829
May	14,769	13,517	30.5	22,771	Nov.	20,755	18,006	33.2	22,362
June	15,871	14,870	31.4	23,058	Dec.	19,249	15,575	32.2	25,427
1940:									
Jan.	20,447	17,596	32.0	25,530	July	.....	.....	...	.....
Feb.	19,060	17,019	34.2	27,019	Aug.	.....	.....	...	.....
Mar.	.....	.....	...	.....	Sept.	.....	.....	...	.....
Apr.	.....	.....	...	.....	Oct.	.....	.....	...	.....
May	.....	.....	...	.....	Nov.	.....	.....	...	.....
June	.....	.....	...	.....	Dec.	.....	.....	...	.....

[a] Stocks on hand at the end of month or year.
* Revised.
Note: Figures for 1938 were revised on June 1, 1939, and are now based on Department of Commerce survey figures.

U. S. Consumption of Gasoline

(Bureau of Mines Statistics)
(In Thousands of Barrels of 42 Gallons)

	1938	1939	1940		1938	1939	1940
January	35,323	37,767*	40,370	August	50,549	53,828*	.....
February	31,981	34,595	37,557	September	46,150	49,347	.....
March	41,409	42,520	.....	October	46,365	49,687	.....
April	43,430	43,977	.....	November	45,084	47,275	.....
May	44,937	49,547	.....	December	41,742	43,694	.....
June	48,383	49,812	.....				
July	47,650	50,508	.....	Total	523,003	552,557*	.....

* Revised.

Rims Inspected and Passed in U. S.

(Tire and Rim Association Reports)

	Total		Total		Total
1928	24,247,282	1932	6,261,336	1936	20,790,192
1929	24,141,502	1933	8,713,962	1937	22,257,964
1930	17,364,096	1934	12,255,116	1938	10,612,138
1931	11,253,800	1935	18,664,356	1939	17,471,914

1940		1940		1940	
January ...	2,163,914	May	.....	September ..	.....
February ..	1,850,383	June	.....	October ...	.....
March	.....	July	.....	November ..	.....
April	.....	August	.....	December ..	.....

REENFORCING CALCIUM CARBONATE

CALCENE

- High Tensile
- High Tear Resistance
- Low Modulus
- Smooth Processing
- Low Volume Cost

THE COLUMBIA ALKALI CORPORATION, NEW YORK

ROBERT BADENHOP CORPORATION

CRUDE RUBBER

GUTTA PERCHA
LIQUID LATEX

GUTTA SIAK
BALATA

WOOLWORTH BLDG. (TEL. CORTLAND 7-6920) NEW YORK, N.Y.

NEOPHAX — Vulcanized Vegetable Oils FOR NEOPRENE

Reg. U. S. Pat. Off.

"Neoprene can be loaded with FACTICE and fillers to a greater extent than rubber and yet retain its rubber-like properties to a remarkable degree. Such stocks tube smoothly and rapidly, calender nicely at low heats and, when vulcanized, give snappy, rubbery stocks."

Reg. U.S. Pat. Off.

THE STAMFORD RUBBER SUPPLY CO. STAMFORD CONN.

Makers of FACTICE Since 1900

Reg. U.S. Pat. Off.

Daily Spot Closing Prices of Ribbed Smoked Sheet Rubber—*New York Market, in Cents per Pound*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Ave.
1938																																
Jan.	——	——	14 7/8	14 7/8	14 3/4	14 3/8	14 3/8	14 3/8	——	——	14 1/2	14 3/8	14 3/8	14 3/8	——	14 3/8	14 1/2	14 1/2	14 1/2	14 1/2	14 3/8	14 1/2	14 1/2	——	14 3/8	14 1/2	14 3/4	14 3/8	14 3/8	——	——	14 3/8
Feb.	14 1/2	14 7/8	14 7/8	14 7/8	14 3/4	——	14 3/8	14 3/8	14 3/8	——	——	——	——	14 3/8	14 3/8	14 3/8	14 1/2	14 1/2	14 1/2	——	14 3/8	——	14 1/2	14 1/2	14 1/2	14 1/2	14 3/8	14 3/8	14 3/8	——	——	14 3/8
Mar.	14 1/2	14 7/8	14 7/8	14 7/8	14 3/4	14 3/8	14 3/8	14 3/8	14 3/8	——	——	14	14 3/8	14 3/8	14 3/8	14	14 1/2	14 1/2	13 7/8	——	13 3/4	13 3/4	13 3/4	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	14 1/2	——	——	14 1/2
April	11 7/8	11 7/8	11 7/8	11 7/8	11	11 3/8	11 3/8	11 3/8	11 3/4	12	11 3/4	11 3/8	12 3/4	12 1/2	12 1/2	12	11 1/2	11 7/8	12 1/4	12 1/4	12 1/4	12 3/4	12 3/4	12 3/4	12 3/4	12 3/4	11 3/4	11 3/4	11 3/4	10 1/2	10 1/2	11 3/8
May	10 7/8	——	——	——	——	——	——	——	12	——	12	12	12	11 7/8	——	——	11 1/2	11 3/4	12	12	11 3/4	12 3/4	12 3/4	12 3/4	12 3/4	12 3/4	11 3/4	11 3/4	11 3/4	11 3/4	11 3/4	11 3/8
June	11 3/4	——	——	——	11 3/4	——	11 3/4	11 3/4	——	——	14 3/4	15 1/8	15 1/8	14 7/8	15 1/8	15 1/4	15 1/2	15 1/2	15 1/2	15 1/2	15 3/4	——	——	15 3/8	15 3/8	15 3/8	14 1/2	14 3/8	14 1/2	——	——	12 1/2
July	11 3/4	——	11 7/8	11 7/8	11 3/4	11 1/2	11 1/2	11 3/4	12	12	15 1/8	15 1/8	15 1/8	14 7/8	15 1/8	15 1/4	15 1/2	15 1/2	15 1/2	15 1/2	15 3/4	16	16	15 3/8	15 3/8	15 3/8	15 1/2	15 3/8	15 1/2	——	——	15 3/5
August	15 1/8	15 1/8	15 1/8	15 1/8	16	15 7/8	16 1/8	16 1/8	16 1/8	15 1/8	15 1/8	15 1/8	16 1/8	16 1/8	15 7/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
Sept.	15 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
Oct.	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
Nov.	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
Dec.	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8	15 7/8
1939																																
Jan.	——	——	16 1/8	16 1/8	16	16	16	——	15 1/8	16	15 1/8	15 7/8	15 1/8	15 7/8	——	15 3/8	15 3/4	15 1/8	15 1/8	15 3/8	15 3/4	——	——	15 3/8	15 3/8	14 1/2	14 3/8	14 3/8	——	15 1/8	15 3/4	15 3/4
Feb.	15 3/8	15 3/4	16 1/8	——	——	15 1/8	15 1/8	15 1/8	15 1/4	15 1/8	15 1/2	15 1/2	——	——	16 1/8	16 1/8	16	16 1/8	——	——	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/2	16 1/2	16 1/2	15 1/8	15 1/8	15 3/4	15 3/4
March	——	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
April	15 7/8	15 7/8	15 7/8	15 7/8	16	15 7/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
May	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
June	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
July	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
August	16 1/8	16 1/8	16 1/8	16 1/8	——	——	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8	16 1/8
September	19 1/8	18 3/4	——	——	——	21 1/2	19 1/2	20	22	19	——	23 3/4	22 1/4	19 3/4	——	22	22	22	22	22	22	22	22	21 3/4	21 3/4	21 3/4	21 3/4	21 3/4	21 3/4	21 3/4	21 3/4	21 3/4
October	——	20	19 1/2	19 3/4	19 3/4	19 3/4	——	——	20 3/8	19 3/4	20 1/2	20 1/2	20 1/2	20 1/2	20	20	20 1/2	20 3/4	20	20	20 1/2	20	20	20 1/2	20 1/2	20 1/2	20	20	20	20 1/2	20 1/2	20 1/2
November	20 3/4	20 1/2	20 1/4	20 1/4	19 3/4	19 3/4	20 1/2	19 3/4	19 3/4	——	——	——	——	——	20	20 3/4	20	20	20	20 1/2	20	20	20	20	20	20	20	20	20	20	20	20
December	20	20	——	——	19 3/4	——	——	——	——	——	——	20 1/4	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——	——
1940																																
January	19 3/8	19 3/8	19 3/8	19 3/8	19 3/8	19 3/8	19 3/8	18 1/2	——	19 3/8	19 3/4	19 3/4	19 1/2	19 3/8	19 1/2	19 1/2	19 1/2	19 1/2	19 1/2	19	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	18 3/8	19
February	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	19 3/8	18 3/4	18 3/4	19 1/8	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	19 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4
March	18 1/2	18 1/2	18 1/2	18 1/2	18 3/8	18 3/8	18 3/8	18 1/2	18 1/2	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4	18 3/4
April	18 1/2	18 5/8	18 5/8	18 5/8	18 5/8	18 7/8	18 7/8	——	——	18 7/8	19	19	19	18 7/8	18 7/8	18 7/8	18 7/8	18 7/8	18 7/8	18 7/8	18 5/8	18 5/8	18 5/8	18 5/8	18 5/8	18 5/8	18 5/8	18 5/8	18 5/8	18 7/8	18 7/8	——	18 7/8

Average Spot Closing Prices—Ribbed Smoked Sheets

(New York Markets)

Average Price per Pound for Years 1913-1932

Year	Cents	Year	Cents	Year	Cents	Year	Cents	Year	Cents
1913	82.04	1917	72.23	1921	16.36	1925	72.46	1929	20.59
1914	65.33	1918	60.15	1922	17.50	1926	48.50	1930	11.98
1915	65.85	1919	48.70	1923	29.45	1927	37.72	1931	6.17
1916	72.50	1920	36.30	1924	26.20	1928	22.48	1932	3.49

Average Monthly Price per Pound Since 1933

	1933 Cents	1934 Cents	1935 Cents	1936 Cents	1937 Cents	1938 Cents	1939 Cents	1940 Cents
Jan.	3.08	9.32	13.10	14.35	21.37	14.63	15.75	19.06
Feb.	2.95	10.45	12.92	15.48	21.33	14.71	15.93	18.83
Mar.	3.01	11.01	11.51	15.89	24.09	13.55	16.26	18.58
Apr.	3.56	12.10	11.55	15.98	23.44	11.84	15.87	
May	4.95	13.26	12.05	15.62	21.14	11.57	16.07	
June	6.15	13.51	12.57	15.85	19.29	12.57	16.37	
July	8.01	14.60	12.10	16.49	18.86	15.37	16.51	
Aug.	7.31	15.47	11.98	16.25	18.37	16.08	16.67	
Sept.	7.30	15.36	11.55	16.46	18.55	16.15	21.24	
Oct.	7.64	13.96	12.62	16.55	16.28	16.89	19.89	
Nov.	8.66	13.04	13.15	17.97	14.60	16.24	20.21	
Dec.	8.87	12.98	13.28	20.01	15.41	16.05	20.01	
Average for Year	5.96	12.92	12.37	16.41	19.39	14.64	17.57	

London Closing Prices of Ribbed Smoked Sheets

(In Pence Per Pound)

Day	1940 Jan.	1940 Feb.	1940 Mar.	1940 Apr.	Day	1940 Jan.	1940 Feb.	1940 Mar.	1940 Apr.
1	——	11 13/16	12 7/16	11 3/4	17	11 5/8	——	——	
2	11 5/8	11 13/16	——	11 5/8	18	11 13/16	——	11 7/16	
3	11 5/8	——	——	11	19	11 3/4	13 1/4	11 7/16	
4	11 5/8	——	12 3/8	10 13/16	20	——	13 5/8	11 7/8	
5	11 5/8	11 13/16	12 1/4	10 13/16	21	——	12 13/16	11 1/4	
6	——	11 13/16	12 1/4	——	22	12 1/16	12 3/4	——	
7	——	12 1/16	12 1/8	——	23	11 7/8	12 3/4	——	
8	11 5/8	12 5/8	12 1/8	10 13/16	24	11 13/16	——	——	
9	11 3/4	12 7/8	——	11 1/8	25	11 7/8	——	——	
10	11 13/16	——	——		26	11 13/16	13 1/16	11 1/4	
11	11 13/16	——	12 1/8		27	——	12 13/16	11 7/8	
12	11 13/16	12 7/8	12		28	——	12 5/8	11 1/8	
13	——	12 13/16	11 3/4		29	11 13/16	12 7/8	11 1/8	
14	——	12 3/4	11 3/8		30	11 13/16	——	——	
15	11 5/8	13 1/8	11 3/8		31	11 13/16	——	——	
16	11 13/16	13	——						

Average Monthly Price Per Pound

Month	1937 Pence	1938 Pence	1939 Pence	1940 Pence	Month	1937 Pence	1938 Pence	1939 Pence	1940 Pence
Jan.	10.378	7.077	7.926	11.793	Aug.	8.830	7.841	8.545	
Feb.	10.503	7.029	7.942	12.577	Sept.	8.935	7.918	9.634	
Mar.	11.766	6.590	8.120	11.651	Oct.	7.855	8.355	10.177	
Apr.	11.471	5.793	7.910		Nov.	7.080	8.111	11.210	
May	10.250	5.632	8.002		Dec.	7.332	8.005	11.559	
June	9.548	6.147	8.216		Average for Year.	9.424	7.164	8.959	
July	9.136	7.464	8.271						

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market)

Recent Daily Price Per Pound

Date	1940 Feb.	1940 Mar.	1940 Apr.	Date	1940 Feb.	1940 Mar.	1940 Apr.	Date	1940 Feb.	1940 Mar.	1940 Apr.
1	10.89	11.07	10.74	11	——	10.97		22	——	——	
2	10.87	10.95	10.73	12	——	10.96		23	11.22	——	
3	10.81	——	10.85	13	11.01	10.82		24	11.28	——	
4	——	11.08	10.84	14	11.11	10.88		25	——	10.79	
5	10.89	11.12	10.85	15	11.09	10.90		26	11.33	10.65	
6	10.98	11.03	10.84	16	11.14	10.77		27	11.26	10.73	
7	11.02	11.08	——	17	11.18	——		28	11.23	10.79	
8	11.02	11.08	10.88	18	——	10.72		29	11.20	10.79	
9	11.12	11.03	10.93	19	11.18	10.73		30	——	10.85	
10	11.17	——		20	11.19	10.87		31	——	——	
				21	11.18	10.84					

Average Monthly Price Per Pound

	1937 Cents	1938 Cents	1939 Cents	1940 Cents		1937 Cents	1938 Cents	1939 Cents	1940 Cents
Jan.	13.06	8.57	8.94	11.19	Aug.	10.41	8.41	9.30	
Feb.	13.15	8.91	8.97	11.10	Sept.	9.02	8.17	9.30	
Mar.	14.46	8.92	9.00	10.90	Oct.	8.42	8.61	9.24	
Apr.	14.23	8.76	8.87		Nov.	7.96	9.08	9.73	
May	13.34	8.50	9.56		Dec.	8.26	8.72	10.97	
June	12.70	8.38	9.88		Average for Year	11.44	8.66	9.46	
July	12.26	8.85	9.71						

Stocks of Crude Rubber

(All figures are in long tons)

ON HAND OR AFLOAT TO THE U. S.

End of:	ON HAND 1938	1939	1940	AFLOAT 1938	1939	1940	ON HAND AND AFLOAT 1938	1939	1940
Jan.	276,497	223,879	156,830	57,356	48,210	90,285	333,853	272,089	247,115
Feb.	292,067	217,534	148,776	47,459	55,814	112,257	339,526	273,348	261,033
Mar.	301,762	205,936		41,882	55,981		343,644	261,917	
Apr.	303,901	190,896		39,071	57,918		342,972	248,814	
May	300,907	193,602		32,859	54,046		333,766	247,648	
June	294,796	181,794		32,079	51,274		326,875	233,068	
July	282,785	174,240		40,400	52,990		323,185	227,230	
Aug.	273,841	161,362		47,772	66,717		321,613	228,079	
Sept.	268,094	150,171		48,927	68,310		317,021	218,481	
Oct.	259,074	133,183		51,062	100,500		310,136	233,683	
Nov.	242,592	118,535		51,114	114,044		293,706	232,579	
Dec.	231,500	140,280		45,105	91,095		276,605	231,375	

STOCKS IN GREAT BRITAIN

(No. of Tons in Wharves and Warehouses, not including Latex)

At end of	London 1938	1939	1940	Liverpool 1938	1939	1940
January	40,203	51,420	12,000*	21,711	28,789	8,000*
February	46,596	48,312	10,000*	24,737	26,784	7,000*
March	50,233	46,768		26,220	24,996	
April	54,296	44,760		28,277	23,742	
May	57,194	43,454		29,862	22,211	
June	60,307	42,374		31,837	21,176	
July	62,236	37,772		32,825	19,116	
August	65,113	28,363		34,315	16,218	
September	63,321	24,965*		34,645	14,054*	
October	59,609	23,685*		33,483	13,336*	
November	57,794	23,244*		32,116	13,087*	
December	55,668	19,545*		31,012	11,006*	

* Estimated.

(Figures up to August, 1939, from the Rubber Trade Association of London)

STOCKS IN OTHER CENTRES

(Figures from Statistical Bulletin of the Int'l Rubber Regulation Committee)

	Penang and Singapore [1]	Malaya [2]	Ceylon [3]	Holland	Para and Manaos
At end of 1939					
January	30,975	59,155	4,827	198	1,557
February	28,559	59,399	4,318	183	1,826
March	23,255	58,005	3,389	137	2,244*
April	22,434	55,238	3,648	131	2,209
May	20,849	52,837*	4,005	136	1,966
June	19,563*	55,834	3,771	101	1,821
July	27,042	55,948	4,217	188	1,474
August	20,543*	50,625	3,134	315	1,914
September	23,457*	52,755	2,742	...	2,682
October	25,376*	46,264	3,335	...	3,419
November	22,957*	45,133	5,289	...	4,510
December	15,346	54,868	5,149	...	5,336
At end of 1940					
January	35,974	.....	5,755	...	2,862

[1] Dealers' and Port Stocks. [2] Inside Regulated Areas. [3] Dealers' Stocks Only.
* Revised.

RUBBER STOCKS AFLOAT

End of:	Afloat for United States	Afloat for Europe	All Other * Afloat	Total * Afloat
1939				
February	55,814	28,300	21,886	106,000
March	55,981	25,200	20,819	102,000
April	57,918	27,200	13,882	99,000
May	54,046	25,700	16,254	96,000
June	51,274	25,260	11,466	88,000
July	52,990	31,000	21,010	105,000
August	66,717	30,000	23,283	120,000
September	68,310	30,000	35,690	134,000
October	100,500	35,000	37,500	173,000
November	114,044	35,000	21,956	171,000
December	91,095	35,000	25,905	152,000
1940				
January	90,285	54,715	30,000	175,000
February	112,257	.....	.....	.....

* *Total Afloat* is an arbitrary estimate based on 1½ months' shipments as adopted by the Department of Commerce. *All Other Afloat* is determined by subtracting the amount of stocks in transit to the United States and Europe from the estimated total.

TOTAL PRINCIPAL WORLD STOCKS

(Figures from the Survey of Current Business)

At End of:	1934	1935	1936	1937*	1938*	1939
January	661,948	698,153	600,479	454,249	549,762	497,665
February	663,308	686,195	599,355	445,265	565,833	479,578
March	666,382	678,809	583,318	447,856	586,666	460,723
April	658,796	677,006	567,172	428,249	586,291	438,252
May	689,239	677,569	541,871	413,134	568,158	429,979
June	672,804	671,525	520,255	434,250	573,136	407,640
July	676,200	679,061	519,074	445,782	580,654	418,639
August	674,702	680,644	500,520	457,462	565,394	397,345
September	694,361	661,509	493,585	470,768	551,447	396,867
October	680,616	655,000	486,159	479,398	540,976	413,274*
November	684,408	617,300	466,491	493,266	512,196	395,217
December	705,975	613,987	466,576	545,533	482,852	391,125
Monthly Avge.	677,395	666,397	528,738	460,022	555,280	427,192

* Revised.

U. S. Tire and Tube Statistics[1]

(All Figures Represent Thousands)

AUTOMOBILE CASINGS

Production Figures on Quarterly Basis

Quarter	1932	1933	1934	1935	1936*	1937*	1938*	1939
Jan.-Mar.	11,004	6,635	13,437	13,355	11,376	15,565	7,314	13,702*
Apr.-June	12,980	14,412	13,565	12,597	14,892	15,834	7,380	13,490*
July-Sept.	9,245	14,707	9,822	11,312	14,914	12,207	10,794	15,109*
Oct.-Dec.	6,856	9,550	10,406	12,099	14,858	9,704	12,360	14,777
Total	40,085	45,304	47,230	49,363	56,040	53,310	37,848	57,078

Shipment Figures on Quarterly Basis

Quarter	1932	1933	1934	1935	1936*	1937*	1938*	1939
Jan.-Mar.	8,760	6,981	10,730	11,154	10,554	14,143	7,388	12,150*
Apr.-June	18,021	15,139	14,998	13,473	15,940	15,741	9,564	14,908*
July-Sept.	8,141	13,707	11,648	13,489	14,037	13,106	11,243	15,745*
Oct.-Dec.	5,329	8,265	9,310	12,066	12,855	10,495	12,098	14,172
Total	40,251	44,092	46,686	50,182	53,386	53,485	40,293	56,975

Inventory Figures [2]

Quarter	1932	1933	1934	1935	1936*	1937*	1938*	1939
Jan.-Mar.	9,878	7,290	11,651	11,675	8,762	12,004	10,547	10,248*
Apr.-June	4,999	6,615	10,219	10,755	7,556	12,081	8,337	8,909*
July-Sept.	6,096	7,595	8,419	8,288	8,690	11,200	7,859	8,364*
Oct.-Dec.	7,644	8,888	9,455	8,196	10,717	10,383	8,166	8,688

Figures for Recent Months

	PRODUCTION 1938	1939	1940	SHIPMENTS 1938	1939	1940	INVENTORY [2] 1938	1939	1940
Jan.	2,745	4,464	4,977	2,498	4,057	4,277	10,801	8,932	9,389
Feb.	2,195	4,233	4,911	2,342	3,640	4,118	10,559	9,573	10,157
Mar.	2,728	5,005		2,858	4,453		10,521	10,248	

AUTOMOBILE INNER TUBES

Production Figures on Quarterly Basis

Quarter	1932	1933	1934	1935	1936*	1937*	1938*	1939
Jan.-Mar.	10,721	6,230	12,823	12,553	11,891	15,831	7,314	12,385*
Apr.-June	11,913	13,001	13,191	11,631	14,624	15,413	7,380	12,067*
July-Sept.	8,286	14,356	10,321	11,270	15,320	12,038	10,794	13,505*
Oct.-Dec.	5,970	9,000	9,891	12,425	15,201	9,092	12,360	13,410
Total	36,890	42,587	46,226	47,879	57,036	52,374	37,848	51,367

Shipment Figures on Quarterly Basis

Quarter	1932	1933	1934	1935	1936*	1937*	1938*	1939
Jan.-Mar.	8,918	6,539	10,640	11,252	11,367	14,606	7,387	11,371*
Apr.-June	16,271	13,292	14,553	11,928	15,113	15,495	9,564	13,233*
July-Sept.	7,761	13,370	11,545	13,251	15,069	12,901	11,243	13,759*
Oct.-Dec.	4,961	8,189	8,306	11,636	12,874	9,765	12,099	13,395
Total	37,911	41,390	45,044	48,067	54,423	52,767	40,293	51,758

Inventory Figures [2]

Quarter	1932	1933	1934	1935	1936*	1937*	1938*	1939
Jan.-Mar.	9,448	6,369	10,244	10,406	8,660	11,993	10,547	9,163*
Apr.-June	5,174	6,097	8,795	10,050	8,075	11,833	8,337	8,044*
July-Sept.	5,753	7,008	7,639	7,565	8,595	11,326	7,859	7,846*
Oct.-Dec.	6,749	7,815	9,180	8,231	10,945	10,312	8,166	7,174

Figures for Recent Months

	PRODUCTION 1938	1939	1940	SHIPMENTS 1938	1939	1940	INVENTORY [2] 1938	1939	1940
Jan.	2,516	4,119	4,287	2,527	3,943	3,827	10,582	8,069	7,634
Feb.	2,216	3,733	4,211	2,216	3,372	3,810	10,579	8,415	7,897
Mar.	2,582	4,533		2,645	4,056		10,547	9,163	

[1] Based on reports received from the Rubber Manufacturers Association.
[2] Held by manufacturers at end of period indicated.
* Revised.

Automobile Production

Year	United States Total	Passenger Cars	Trucks	Canada Total	Passenger Cars	Trucks	Grand Total
1929	5,358,420	4,587,400	771,020	263,295	207,498	55,797	5,621,715
1930	3,355,986	2,814,452	540,534	154,192	125,442	28,750	3,510,178
1931	2,389,730	1,973,090	416,640	82,621	63,477	19,144	2,472,351
1932	1,370,678	1,135,493	235,187	60,816	50,718	10,098	1,431,494
1933	1,920,057	1,573,512	346,545	65,924	53,855	12,069	1,992,126
1934	2,753,111	2,177,919	575,192	116,852	92,647	24,205	2,869,963
1935	3,946,934	3,252,244	694,690	172,877	135,562	37,315	4,119,811
1936	4,454,115	3,669,528	784,587	162,159	128,369	33,790	4,616,274
1937	4,808,974	3,915,889	893,085	207,463	153,046	54,417	5,016,437
1938	2,489,085	2,000,985	488,100	166,086	123,761	42,325	2,655,171
1939*	3,577,292	2,866,796	710,496	155,316	108,806	46,510	3,732,608
1939							
July	209,343	150,738	58,605	9,135	5,112	4,023	218,478
Aug.	99,868	61,384	38,484	3,475	1,068	2,407	103,343
Sept.	188,751	161,625	27,126	3,921	3,494	427	192,672
Oct.*	313,377	251,819	61,558	11,296	7,791	3,505	324,673
Nov.*	351,782	285,252	66,530	16,756	9,882	6,874	368,538
Dec.	452,024	373,755	78,269	16,978	11,491	5,487	469,002
1940							
Jan.	432,101	362,736	69,365	17,213	12,579	4,634	449,314
Feb.	403,627	337,372	66,255	18,193	12,779	5,414	421,820
Mar.	.....	.....	.....	.....	.....	.....	.....

* Revised.
Note: U. S. figures represent factory sales; Canadian figures represent production.

ADVERTISING PAGES REMOVED

Exports of Crude Rubber from Principal Producing Countries

(Long Tons)

	BRITISH MALAYA [1]								NETHERLAND INDIES [4]						
	Gross Exports	Imports	Net Exports	Ceylon [2]	India & Burma [3]	Sarawak [3]	British North Borneo [3]	Thailand [3]	Java & Madura	Sumatra E. Coast	Other N. I.	Indo-China [3]	Amazon Valley	All Other [5]	World Total [6]
1923	252,016	70,432	181,584	39,971	6,416	5,705	4,237	1,718	32,930	46,344	57,822	5,067	16,765	7,856	406,419
1924	259,706	108,524	151,182	39,997	7,697	6,699	4,621	2,962	42,446	54,497	80,347	6,688	23,165	9,065	429,366
1925	316,825	158,022	158,803	49,566	10,082	5,424	5,377	5,377	46,757	65,499	120,626	7,881	25,298	13,797	514,487
1926	391,328	151,243	240,085	58,962	9,874	9,155	6,079	4,027	52,186	71,413	121,231	8,203	24,298	16,017	621,530
1927	371,322	182,845	188,477	55,356	11,321	10,923	6,582	5,472	55,297	77,815	142,171	8,645	28,782	15,633	606,474
1928	409,430	149,787	259,643	57,267	10,790	10,087	6,698	4,813	58,848	82,511	121,770	9,548	21,129	10,690	653,794
1929	574,836	163,092	411,744	81,384	11,663	11,077	7,381	5,018	65,990	87,789	134,037	9,696	21,148	6,767	853,894
1930	347,043	133,876	413,167	76,970	10,782	10,309	6,781	4,251	69,755	79,396	115,254	7,665	14,260	5,651	814,241
1931	519,740	125,506	394,234	61,769	8,470	10,451	6,247	4,218	75,952	87,747	116,009	11,696	12,121	3,292	792,203
1932	478,252	92,539	385,713	48,973	3,888	6,960	4,664	3,451	61,312	79,837	85,871	13,883	6,450	1,816	702,818
1933	573,412	167,377	406,035	63,351	4,527	10,874	7,555	7,765	73,851	91,861	149,659	18,394	9,883	2,737	846,312
1934	677,361	211,803	465,558	79,746	10,492	17,233	11,103	17,545	87,400	112,058	175,470	20,170	8,903	2,985	1,008,663
1935	590,319	174,652	415,667	54,316	13,968	19,465	8,885	28,327	57,488	78,325	139,297	28,816	11,275	8,745	864,574
1936	520,286	167,799	352,487	49,692	14,724	21,243	8,177	33,702	61,307	84,577	152,205	40,782	14,193	11,466	845,431
1937	681,638	213,446	468,192	70,353	17,015	25,922	13,213	5,551	84,085	139,632	207,863	43,399	15,576	13,063	1,133,864
1938	526,911	156,101	370,810	49,528	15,178	17,792	9,512	41,080	57,526	94,501	145,909	58,518	14,618	12,920	887,892
1939	553,324	177,851	375,473	61,026	15,881	24,014	11,864	41,266	72,786	117,791	181,272	65,140	13,892	22,224	1,002,629
1939:															
Jan.	43,332	19,049	24,283	7,237	1,879	2,342	1,604	2,918	6,787	11,261	20,630	4,739	1,708	1,855	87,243
Feb.	43,084	13,889	29,195	5,495	1,565	1,484	664	5,606	4,833	8,410	11,752	5,659	1,056	1,754	77,473
Mar.	43,259	14,035	29,224	3,718	1,392	1,177	344	5,401	5,361	8,048	14,487	4,636	1,331	1,776	76,932
Apr.	43,658	13,996	29,662	2,225	1,260	2,446	1,687	2,660	5,321	9,250	13,768	2,581	1,139	1,753	73,751
May	42,214	12,697	29,517	2,805	1,670	1,649	558	2,782	4,105	8,168	12,155	4,585	874	1,672	70,540
June	31,541	9,567	21,974	3,708	1,435	1,157	332	1,748	5,839	8,846	12,824	4,030	591	1,825	64,309
July	45,962	20,052	25,910	5,019	1,285	3,092	1,603	5,599	5,229	11,020	19,431	3,367	1,019	1,804	84,378
Aug.	53,497	12,635	40,862	5,620	416	1,749	975	5,230	6,236	10,010	11,232	7,020	1,197	1,525	92,072
Sept.	45,094	18,302	26,792	6,064	780	1,932	429	4,670	5,168	10,278	22,270	5,943	1,131	1,832	87,289
Oct.	70,839	21,493	49,346	5,234	815	2,487	1,730	2,047	9,950	13,645	21,404	5,022	1,414	2,185	115,279
Nov.	49,276	13,657	35,619	4,405	819	2,023	1,322	1,428	5,827	10,239	14,163	6,540	1,055	2,191	85,631
Dec.	41,568	8,479	33,089	9,496	2,565	2,476	616	1,177	8,130	8,580	7,156	11,018	1,377	2,052	87,732
1940:															
Jan.	56,214	30,136	26,078	7,091	1,630	1,987	1,858	5,469	6,361	16,070	31,676	5,315	1,777	2,000*	107,212
Feb.	62,105	16,598	45,507	8,741	2,076	2,678	1,164	3,887	7,270	14,873	15,713	7,040	1,427	2,000*	112,376

All figures from January, 1934, onward are net exports shown on a "dry rubber" basis as calculated by the International Rubber Regulation Committee. (1) Prior to January, 1934, Malayan net exports cannot be taken as production, since imported rubber is largely wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex also is not included in the early years, which on a dry rubber basis was as follows: 1924—1,117 tons; 1925—3,618; 1926—3,263; 1927—2,439; 1928—2,247; 1929—3,574; 1930—2,750; 1931—1,940; 1932—5,193; 1933—10,470, and 1934—14,172 tons. (2) Ceylon Chamber of Commerce statistics until 1926; rubber exported as latex is not included—such shipments on a dry rubber basis were: 1923—18 tons; 1924—90; 1925—6; 1926—20; 1927—½; 1928—1; 1929—2; 1930—11; 1931—2; 1932—2; 1933—1, and 1934—6 tons. (3) Official statistics. (4) Exports from "Other N. I." are chiefly wet native rubber, which is reduced about one-third in weight by remilling; rubber exported as latex is not included in earlier years, which is as follows on a dry rubber basis: 1923—2,342 tons; 1924—1,008; 1925—2,239; 1926—44; 1927—84; 1928—1,395; 1929—437; 1930—2,744; 1931—3,874; 1932—3,488; 1933—5,260, and 1934—5,330 tons. (5) Calculated from official import statistics of principal consuming countries; also includes United States imports of guayule. (6) This total includes the third column for British Malaya and all other figures shown for other territories. (*) Figure is provisional.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE: THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.

Net Imports of Crude Rubber into Principal Manufacturing Countries

(Long Tons)

	United States [1]	United Kingdom	France (h)	Germany	Canada (ac)	Japan (da)	Italy	Russia (ce)	Australia (cd)	Belgium (d)	Netherlands	Scandinavia (abcdf)	Spain (g)	Czechoslovakia (abcd)	World Total
1919	238,407	42,671	17,685	5,584	6,395	9,753	9,894	75	1,002	3,995	2,771	3,149	2,418	9	343,808
1920	249,530	56,844	13,885	11,890	11,746	5,297	6,123	62	1,815	3,840	5,510	2,292	2,008	567	371,409
1921	179,736	42,087	15,135	21,920	8,124	21,713	3,906	165	1,014	1,705	1,022	1,279	2,245	569	300,620
1922	296,594	11,724	24,352	27,546	9,207	15,934	6,430	2,493	2,643	172	—3,807	1,778	589	567	396,222
1923	301,527	12,700	27,392	18,519	13,277	15,372	8,489	2,986	1,649	2,184	792	2,528	630	1,128	409,173
1924	319,103	11,550	30,446	22,727	14,299	19,571	8,764	2,346	3,124	2,688	—807	3,178	944	1,370	416,203
1925	385,596	4,061	32,956	33,937	19,683	11,117	11,412	7,088	4,757	2,930	875	3,149	1,155	1,558	520,274
1926	399,981	84,865	34,240	22,775	20,229	18,125	9,809	6,529	9,021	2,498	2,670	4,046	1,299	1,870	617,957
1927	403,472	60,249	34,271	38,892	26,405	20,521	11,381	12,018	9,490	5,482	636	4,224	2,055	2,672	632,768
1928	407,572	4,846	36,498	37,855	30,447	25,621	12,433	15,134	8,430	7,958	2,243	4,418	3,178	3,138	599,771
1929	528,608	122,675	55,093	49,275	35,453	34,284	17,169	11,774	15,886	9,445	3,022	6,440	864	4,650	894,638
1930	458,036	120,069	68,503	45,488	28,793	33,039	18,639	16,387	5,354	10,635	2,924	7,710	2,400	4,468	822,445
1931	475,993	86,170	46,466	39,688	25,261	43,483	10,149	30,671	7,649	11,009	2,220	6,360	2,605	7,717	794,641
1932	393,844	44,086	42,506	45,121	20,917	56,027	14,469	30,637	12,576	9,519	2,851	7,262	4,359	9,444	693,618
1933	398,365	73,333	61,953	54,120	19,332	66,831	19,341	29,830	13,534	11,166	1,243	7,831	5,520	10,402	772,803
1934	439,172	158,482	49,560	59,330	28,439	69,905	21,398	47,271	9,642	9,115	3,758	12,418	6,900	10,999	926,389
1935	455,758	128,829	51,450	62,899	26,870	57,567	21,880	37,572	9,978	7,593	4,068	11,878	8,140	11,245	895,727
1936	475,359	—2,591	57,032	71,794	27,871	61,223	16,534	30,967	14,109	9,648	2,888	11,236	6,668	8,772	791,510
1937	592,394	92,707	59,871	98,170	36,088	62,311	24,733	30,462	19,164	14,970	4,343	4,680	2,400	13,063	1,055,356
1938	406,343	133,079	59,660	90,200	25,696	45,836	28,170	25,650	11,944	11,309	5,092	16,034	2,400	9,936	871,349
1938:															
Sept.	34,436	8,100	5,094	7,390	1,405	3,584	1,799	1,725	1,779	519	385	1,830	200*	608	68,854
Oct.	33,830	3,085	3,791	6,326	3,139	3,204	3,921	2,000*	1,780	848	420	3,022	200*	9	65,575
Nov.	32,567	936	5,322	7,275	3,123	4,665	1,984	4,000*	660	636	530	1,209	200*	379	63,486
Dec.	37,051	4,134	5,820	7,481	2,198	4,000	2,355	2,500*	647	876	263	1,013	200*	648	69,186
1939:															
Jan.	36,614	836	4,684	7,227	2,862	2,553	2,133	4,000*	910	898	454	1,037	200*	1,131	65,544
Feb.	30,578	4,773	5,315	7,569	1,451	3,263	2,025	2,000*	1,741	1,068	184	858	200*	524	61,549
Mar.	45,286	8,082	4,503	8,036	2,458	4,019	1,525	2,000*	1,316	1,242	368	1,133	200*	463	80,631
Apr.	31,590	4,752	5,639	8,719	1,466	3,579	1,926	2,000*	1,108	855	333	1,062	200*	597	63,826
May	45,390	7,531	4,646	8,413	3,006	4,438	1,573	2,000*	1,188	792	518	1,654	200*	618	81,967
June	33,951	8,439	4,649	8,190	2,423	3,067	1,992	2,000*	1,308	621	672	2,703	200*	487	70,702
July	36,932	4,040	4,282	8,437	3,164	3,668	1,350	1,000*	1,422	859	565	824	200*	412	67,155
Aug.	38,319	2,044	4,000*	....	2,033	3,145	1,500*	2,000*	2,182	952	651	1,546	200*	400*	58,972
Sept.	36,197	4,406	4,000*	....	2,639	9,254	1,500*	2,000*	875	108	222	1,200*	200*	...	63,572
Oct.	39,735	8,530	5,000*	....	5,787	2,749	1,500*	2,000*	1,235	519	653	1,200*	200*	...	69,589
Nov.	41,478	10,500*	5,000*	....	1,709	5,104	1,500*	2,000*	1,200*	667	613	1,200*	200*	...	71,504
Dec.	70,302	5,200*	5,000*	....	3,025	3,961	1,500*	2,000*	1,200*	1,035	1,827	1,200*	200*	...	94,702
1940:															
Jan.	71,619	450	5,000*	.....	5,047	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Feb.	41,797	7,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

a—Including gutta percha. b—Including balata. c—Re-exports not deducted in monthly statistics. d—Including some scrap and reclaimed rubber. e—Official statistics of rubber imports by Soviet Russia. f—Including Norway, Sweden, Denmark and Finland. g—United Kingdom and French exports to Spain except in years prior to 1925. h—French imports have been reduced in order to eliminate imports of gutta percha and to reduce to basis of net weight. [1]—United States imports of guayule are included in this compilation. *—Figure is provisional; final figure will be shown when available.

NOTE: ANNUAL FIGURES ARE MORE ACCURATE: THEY ARE REVISED AT THE END OF THE FOLLOWING YEAR.